TO ELUCIDATE THE BENEFIT OF CONTINUOUS PERINEURAL CATHETERS OVER SINGLE SHOT PERIPHERAL NERVE BLOCKS ACCORDING TO PUBLISHED LITERATURE

Dissertation submitted in partial fulfilment

of the requirements for the degree

M.D. (ANAESTHESIOLOGY)

BRANCH - X

DEPARMENT OF ANESTHESIOLOGY & CRITICAL CARE

TIRUNELVELI MEDICAL COLLEGE

TIRUNELVELI – 627 011

THE TAMIL NADU

Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2016

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This is to certify that the dissertation entitled **"TO ELUCIDATE THE BENEFIT OF CONTINUOUS PERINEURAL CATHETERS OVER SINGLE SHOT PERIPHERAL NERVE BLOCKS ACCORDING TO PUBLISHED LITERATURE"** submitted by **DR.B.K.RUKESH**, in partial fulfillment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamilnadu Dr. M.G.R. Medical University, Chennai , this is a bonafide original research work done by him in the department of Anaesthesiology and Critical Care, Tirunelveli Medical College, under my guidance and supervision during the academic year 2014-2016.

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PRINCIPAL INVESTIGATOR: Dr. B.K. RUKESH, MBBS.,

DESIGNATION OF PRINCIPAL INVESTIGATOR: POST GRADUATE IN ANAESTHESIA
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Dear ,Dr. B.K. Rukesh, MBBS., The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 10.06.2015.

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
6.	Proposed Methods for Patient Accrual Proposed	☐
7.	Curriculum Vitae of the Principal Investigator	☐
8.	Insurance /Compensation Policy	☐
9.	Investigator's Agreement with Sponsor	☐
10.	Investigator's Undertaking	☐
11.	DCGI/DGFT approval	☐
12.	Clinical Trial Agreement (CTA)	☐
13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	☐

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1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
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   b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
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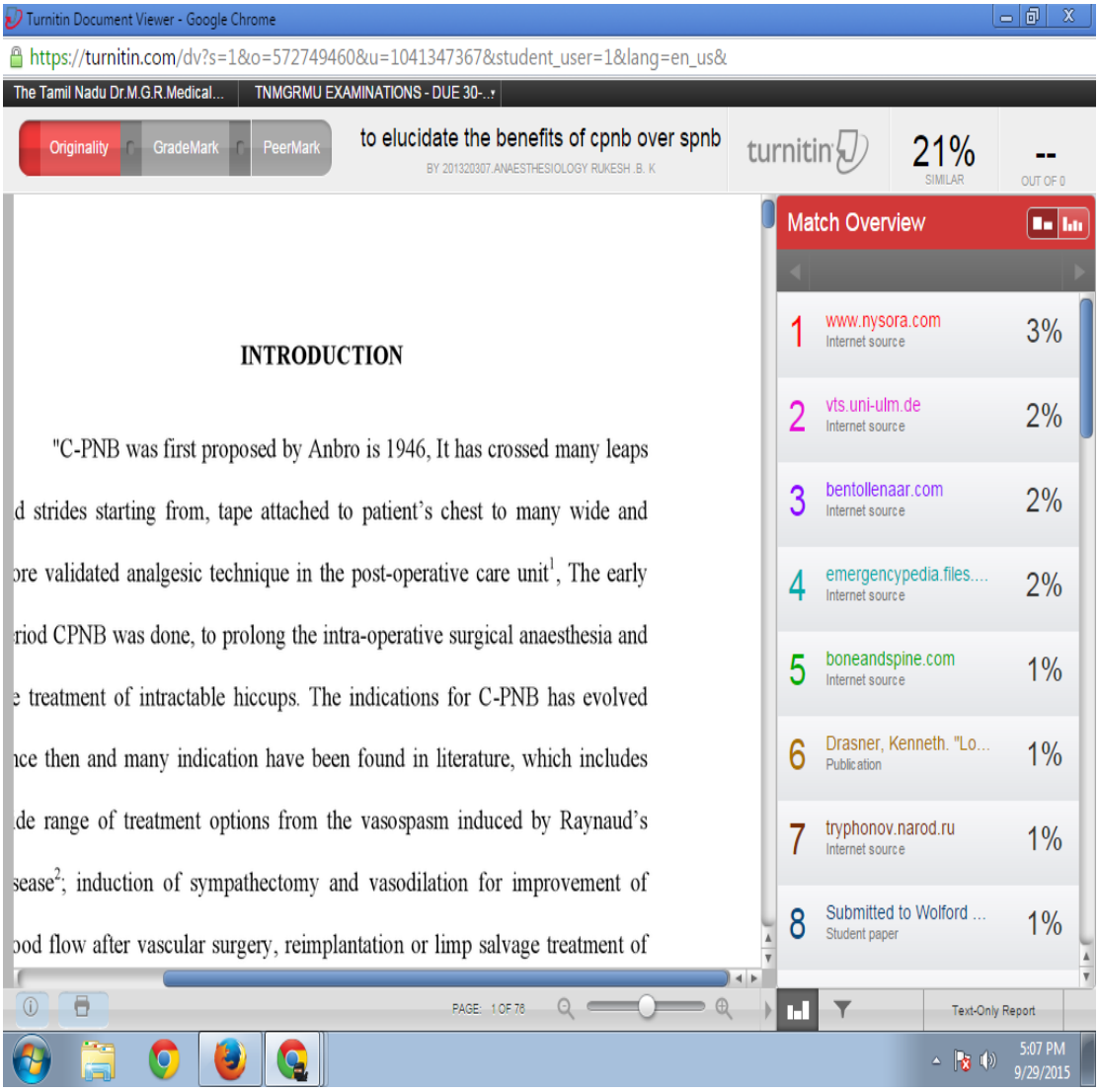
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INTRODUCTION
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ABBREVIATIONS

C-PNB	-	Continuous peripheral nerve block
S-PNB	-	Single shot Peripheral Nerve blocks
ISB	-	Interscalene block
AB	-	Axilary block
SCB	-	Supraclavicular block
DOTS	-	Durations Technique of block in seconds
PR	-	Pulse rate
SPO_2	-	% of Saturation of Haemoglobin with Oxygen
MAP	-	Mean arterial pressure
ASA	-	American Society of Anaesthesiologists
Hb	-	Haemoglobin
BMI	-	Body mass index
22G	-	22 guage needle
ET	-	Endotracheal tube
HR	-	Heart rate
VAS	-	Visual Analogue scale
F	-	Fentanyl
D	-	Diclofenac Sodium
ECG	-	Electrocardiogram
mA	-	Milli Amperage
RCT	-	Randomized Controlled Trials
PACU	-	Post Anaesthesia Care Unit
BT	-	Bleeding Time
CT	-	Clotting Time

ABSTRACT

TO ELUCIDATE THE BENEFIT OF CONTINUOUS PERINEURAL CATHETERS OVER SINGLE SHOT PERIPHERAL NERVE BLOCKS ACCORDING TO PUBLISHED LITERATURE

Aim and Objectives :

This study was performed to compare the efficacy of continuous peripheral nerve blocks over single shot peripheral nerve in upper limb orthopedic surgeries.

Methods and materials

Sixty patients, ASA I and II were randomized into two groups, Group SS received single shot peripheral nerve block, Group CS received continuous peripheral nerve block.

Post-operative pain relief, Break through pain and Rescue Analgesia for the two groups were compared.

Results :

The VAS Score in Group SS (6.27 $\pm$ 1.08) and in Group CS (0.97 $\pm$ 41), and both groups were compared. Break through pain and analgesia score in Group SS (4.53 $\pm$ 0.53) compared with Group CS (0.53 $\pm$ 0.73) and when p value was calculated, it was found to be statistically significant.

Conclusion :

We have concluded that continuous peripheral nerve blocks provide better post-operative pain relief, less incidence of Break through pain and requirement of rescue analgesia is also reduced.

Key words : C-PNB, S-PNB, Breakthrough Pain, Rescue Analgesia, Bupivacaine.

INTRODUCTION

"C-PNB was first proposed by Anbro is 1946, It has crossed many leaps and strides starting from, tape attached to patient's chest to many wide and more validated analgesic technique in the post-operative care unit[1], The early period CPNB was done, to prolong the intra-operative surgical anaesthesia and the treatment of intractable hiccups. The indications for C-PNB has evolved since then and many indication have been found in literature, which includes wide range of treatment options from the vasospasm induced by Raynaud's disease[2]; induction of sympathectomy and vasodilation for improvement of blood flow after vascular surgery, reimplantation or limp salvage treatment of deep vein thrombosis, analgesia in the setting of trauma, treatment of Chronic pain syndrome such as trigeminal neuralgia[3], complex regional pain syndrome, terminal cancer pain, and phantom limb pain. Independently of these indications, the majority of publications dealing with CPNB do focus on pain treatment in post operative treatment where the validation of the theory that the regional anaesthesia and analgesia is superior then opioid based analgesia following major surgery, However post surgical pain is the only indication which is more validated using randomized controlled trails compared with opioid analgesia C-PNB provided better analgesia with less incidence of opiod induced side effects like nausea, vomiting, pruritis and sedation[4], Cochrane review showed no impact of regional anaesthesia compared to general anaesthesia on mortality after hip fractures. Only the acute post operative confusion and delirium was found to reduced after regional anaesthesia,

However for continuous peripheral regional anaesthesia these findings cannot be extrapolated, Though continuous peripheral regional anaesthesia offers improved functional outcomes after extremity surgeries atleast for a short period upto 6 months[5,6,7"]".

"Despite these evidence of value, the hypothesis that regional anaethesia has an overall beneficial and long lasting effect on patient outcome following surgery still remain difficult to prove and has been challenged, especially in times with reduced resources, For more than 30 years regional anaesthesia has challenged anaesthesiologist to determine whether it offers real benefits over other types of anaesthesia, such as preserving cognitive function after major surgery compared to general anaesthesia, improving long term joint function and rehabilitation leading to earlier return to work, reducing costs, reducing the need for blood transfusions and increasing patient – reported outcomes such as satisfaction, quality of life and quality of recovery, This study will compare the benefits of C-PNB over single – shot perineural blocks according to published literature".

Historical Technical Development in Peripheral Nerve Blockades.

During the times of progress in medicine, the discovers of new techniques and pharmacological development of the vibrant 19th century, it was Sir Francis Rynd who performed the first documented nerve block with morphine in 1845, Alexander wood followed this example with better equipment, consisting of a syringe and a needle, to inject morphine close to the

nerves in 1855. In the same period, cocaine, derived from the leaves of Erythroxylon coxa was introduced into clinical practice for its systemic effects. Karl koller, a Viennese ophthalmologist, searched for agents with local insensibility capacities for eye surgery, and by chance he found the Cocaine. Experiments with cocaine followed successfully, after which Koller's instilled cocaine to the eye of patients for local anesthesia prior to surgery. The preliminary results of Koller's clinical trial with cocaine were presented during a meeting of opthalmogist in Heidelberg (1884) In the same year. William S.Halsted, surgeon in New York. Experiment with cocaine after reading Kollers report and performed the first axillary nerve block by injecting cocaine under direct vision near the nerves. Later other local anaesthetics were developed, Because of the addictives and toxic side effects of cocaine. Hirshel and Kuhlenkampff refined the technique to a precutaneous of unpresented approaches and new nerve block techniques often associated with incomplete anesthesia and unexpected failures or complications. In contrast to general anesthesia become less popular due to moderate success rate. The site of needle insertion was defined upon the basis of external anatomical landmarks and eliciting paraesthesia of the nerve with the needle subsequently localizes the nerve. Although Perthes had already described the electrical nerve stimulation in 1912, it took half a century before an electrical stimulator suitable for clinical applications in localizing a nerve was available, Using this method corresponding motor contractions are elicited by electrical stimulation when needle is advanced into the vicinity of the nerve or neural plexus. The current

of the nerve stimulator should be reduced to the threshold at which minimal motor responses are still observed. The quantity of the threshold would be proportional to distance between the needle tip and nerve according to the law of coulomb.AS minimum of 0.3-0.5mA was advised as a safe and effective threshold standard needles were soon replaced by specially designed needles with isolated shaft and blunt tip. This method was believed to contribute to patient safety by reducing the risk of nerve damage, which, however has never been proved. Although the axillary block was the most commonly used technique for anaesthesia of the upper limb, even with guidance by an electrical nerve stimulator, the success rates were still around 80-90% on the basis of anatomical landmark, in 2002 a percutaneous variant of the invasive nerve stimulation technique was developed. This technique was for pre-locating the nerve by indenting the skin with an electrical stimulation pen to elicit accompanying motor and sensory response. The stimulation pen was believed to assist in determining the optimal puncture site for superficial nerve electrical stimulation pen in a value nerve stimulates remains evident and this technique is often used in combination with ultrasound to identify the nerves with more safety and reliability. Nerve stimulation provides functional information to the inexperienced users of ultra sonography in addition to the ultrasonography images of the targeted nerves.

ANATOMY[17]

An understanding of regional anesthesia anatomy and technique is required for the present day anesthesiologist, for their practice, although anatomic relationships have not changed over time, our ability to identify them has evolved. From the paraesthesia – seeking techniques described by Winnie in the mid – twentieth century, to the popularization of the nerve stimulator, to the introduction of ultrasound guidance, anesthesiologists and their patients have benefitted from technology's evolution. The field of regional anesthesia has accordingly expanded to one that addresses not only the intra operative concerns of the anesthesiologist, but also longer term peri-operative pain management.

In addition to potent analgesia, regional anesthesia may lead to reductions in the stress response, systemic analgesic requirements, opioid – related side effects, general anesthesia requirements, and possibly the development of chronic pain.

Patient Selection :

The Selection of a regional anesthetic technique is a process that begins with a thorough history and physical examination. Although many patients are candidates for regional anesthesia / analgesia, as with any medical procedure a risk – benefit analysis must be performed. The risk – benefit ratio often favors regional anesthesia in patients with multiple comorbidities for whom a general anesthetic carries a greater risk. In addition, patients intolerant to systemic

analgesics (eg. those with obstructive sleep apnea or at high risk for nausea) may benefit from the opioid – sparing effects of a regional analgesic. Patients with chronic pain and opioid tolerance may receive optimal analgesia with a continuous peripheral nerve block (so called perinueral local anesthetic infusion).

A comprehensive knowledge of anatomy and an understanding of the planned surgical procedure are important for selection of the appropriate regional anesthetic technique. If possible, discussion with the surgeon about various considerations (tourniquet placement, bone grafting, projected surgical duration) is ideal. Also, knowing the anticipated course of recovery and anticipated level of postoperative pain will often influence specific decisions regarding a regional anesthetic technique (eg. a single injection versus continuous peripheral nerve block).

Nerve Stimulation Technique

For this technique, an insulated needle tip, while a wire attached to the needle hub connect to a nerve stimulator-a battery-power machine that emits a small amount (0-5 mA) of electric current at a set interval (usually 1 or 2 Hz). A grounding electrode is attached to the patient to complete the circuit. When the insulated needle is placed in proximity to a motor nerve, muscle concentrations are induced, and local anesthetic is injected. Although it is common to redirect the block needle until muscle contractions occur at a current less than 0.5 mA, there is scant evidence to support this specific current

in all cases. Similarly, although some have suggested that muscle contraction with current less than 0.2 to 0.5 mA implies intraneural needle placement, there is little evidence to support this specific cutoff. Nonetheless, most practitioners inject local anesthetic, when current between 0.2 mA results in a muscle response. For most blocks using this technique, 30-40mL of anesthetic is usually injected with gentle aspiration between divided doses.

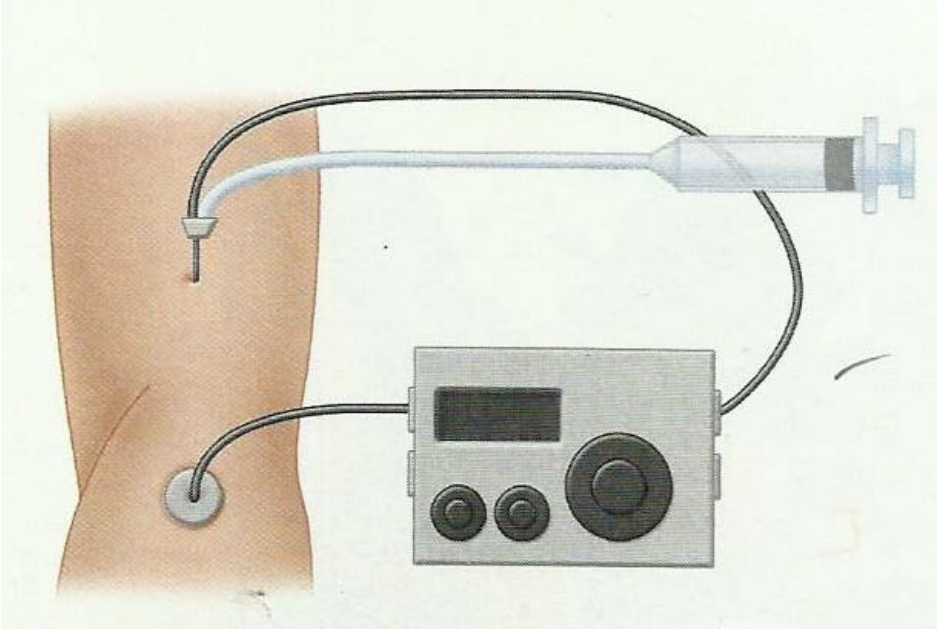


Fig.1 A nerve stimulator delivers a small amount of electric current to the block needle to facilitate nerve localization.

Continuous Peripheral Nerve Blocks

Also termed *perineural local anesthetic infusion*, continuous nerve blocks involve the placement of a percutaneous catheter adjacent to a peripheral nerve, followed by local anesthetic administration to prolong a nerve block. Potential advantages appear to depend on successfully improving analgesia and dynamic pain, supplemental analgesic requirements,

opioid - related side effects, and sleep disturbances. In some cases patient satisfaction, ambulation, and functioning may be improved; an accelerated resumption of passive joint range-of-motion realized; and reduced time until discharge –readiiness as well as actual discharge from the hospital or rehabilitation center achieved There are many types of catheters, including nonstimulating and stimulating, flexible and more rigid, through-the-needle and over-the-needle. Currently, there is little evidence that a single design results in superior effects. Local anesthetic is the primary medication infused, as adjuvants do not add benefits to perineural infusions (unlike single-injection peripheral nerve blocks). The recent evidence suggests that it is the total dose, and not concentration, that determines the majority of block effects. Unlike single-injection peripheral nerve blocks, no adjuvant added to a perineural local anesthetic infusion has been demonstrated to be of benefit. The local anesthetic may be administered exclusively as repeated bolus doses or a basal infusion, or as a combination of the two methods. Using a small, portable infusion pump, continuous peripheral nerve blocks may be provided on an ambulatory basis.

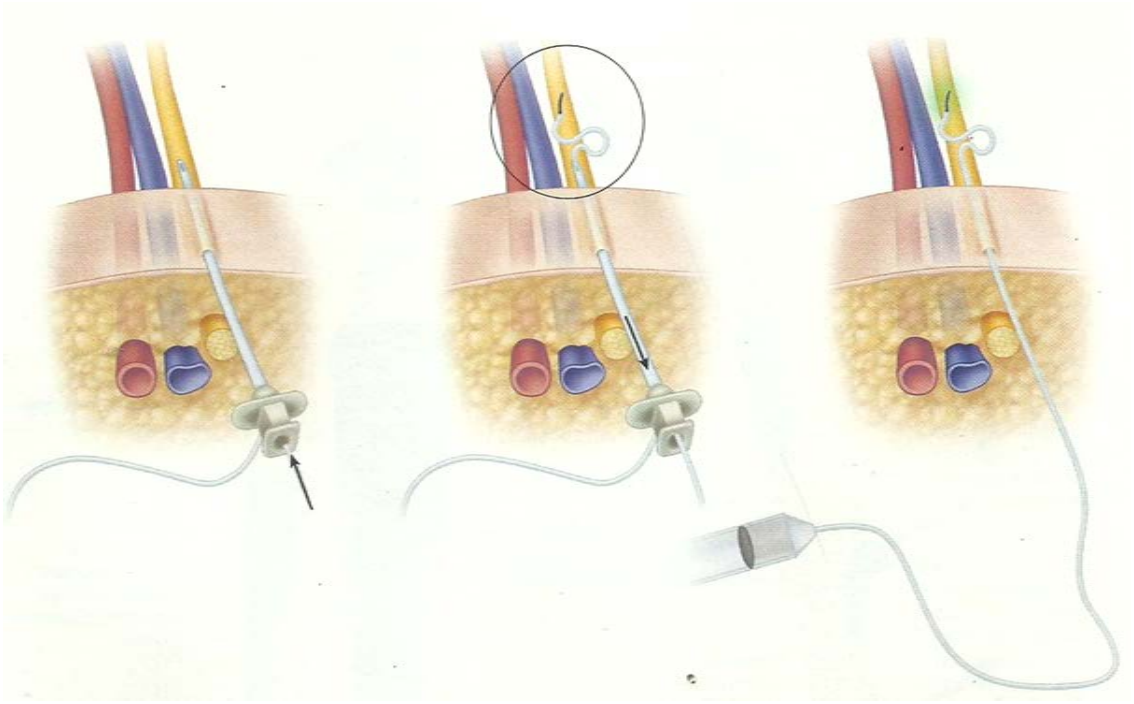


Fig.2. Placement of a percutaneous catheter adjacent to a peripheral nerve.

As with all medical procedures, they are potential risks associated with continuous peripheral nerve blocks. Therefore, these infusions are usually reserved for patients having procedures expected to result in postoperative pain that is difficult to control with oral analgesics and will not resolve in less time than the duration of single injection peripheral nerve block. Serious complications, which are relatively rare, include systemic local anesthetic toxicity, catheter rejection, nerve injury, infection, and retroperitoneal hematoma formation. In addition, a perineural infusion affecting the femoral nerve increases the risk of falling, although to what degree and by what specific mechanism (eg. sensory, motor, or proprioception deficits) remains unknown.

Supraclavicular Block :

Once described as the “spinal of the arm”, a supraclavicular block offers dense anesthesia of the brachial plexus for surgical procedures at or distal to the elbow (figure). Historically, the supraclavicular block fell out of favor due to the high incidence of complications (namely, pneumothorax) that occurred with paresthesia and nerve stimulator techniques. It has seen a resurgence in recent years as the use of ultrasound guidance has theoretically improved safety. The supraclavicular block does not reliably anesthetize the axillary and supravascular nerves, and thus is not ideal for shoulder surgery. Sparing of distal branches, particularly the Ulnar nerve, may occur. Supraclavicular perineural catheters provide inferior analgesia compared with infraclavicular infusion and are often displaced due to a lack of muscle mass to aid catheter retention.

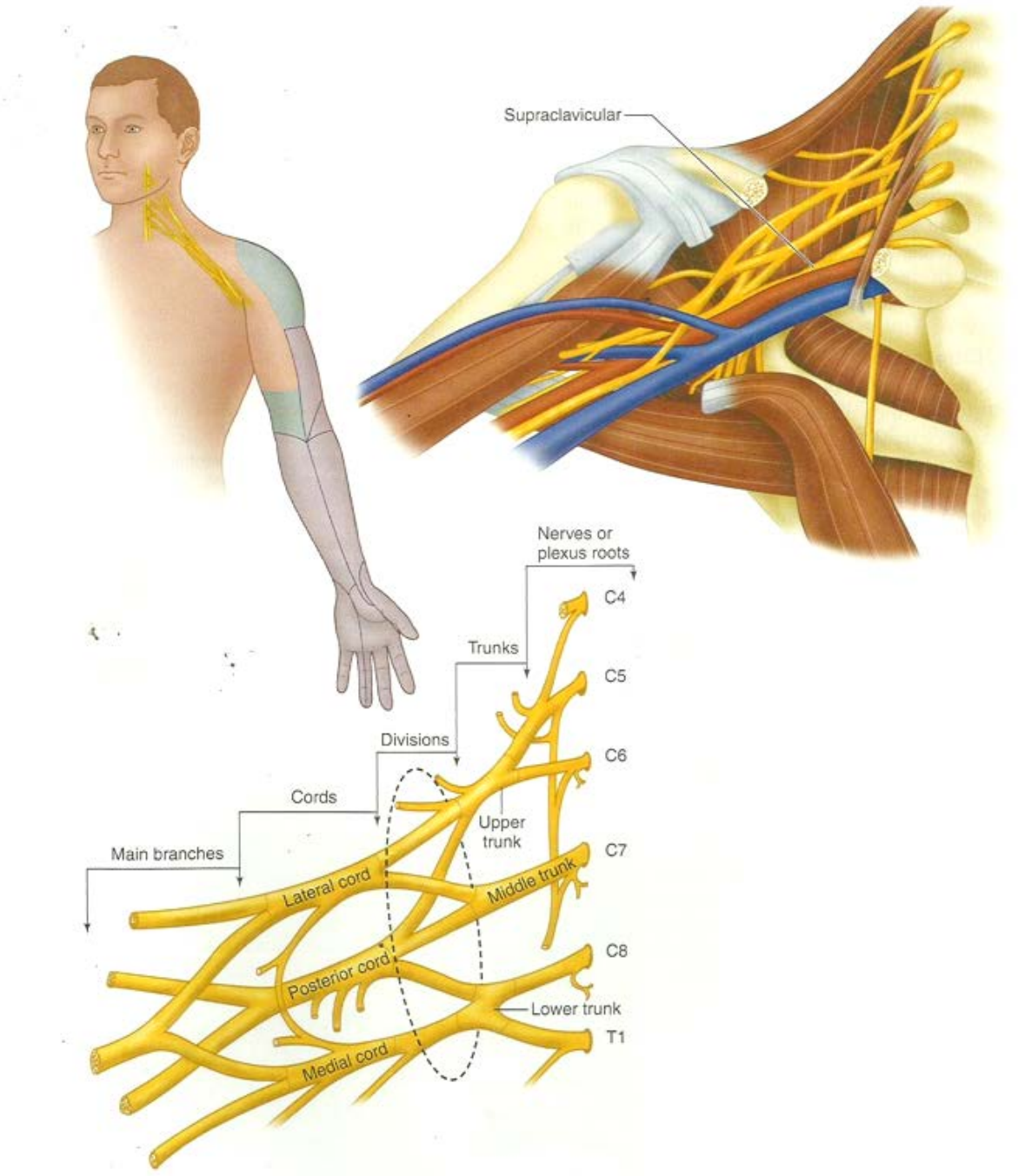


Fig.3 Supraclavicular block can provide dense anesthesia for procedures at or distal to the elbow. Light blue shading indicates regions of variable blockade; purple shading indicates regions of more reliable blockade.

Many of the same precautions that are taken with patient selection for an interscalene block should be exercised with a supraclavicular block. Nearly half of patients undergoing supraclavicular block will experience ipsilateral

phernic nerve palsy, although this incidence may be decreased by using ultrasound ultrasound guidance, allowing use of a minimal volume of local anesthetic. Horner's syndrome and recurrent laryngeal nerve palsy may also occur. Pneumothorax and subclavian artery puncture, although theoretically less likely under ultrasound guidance, remain potential risks.

Axillary Block :

At the lateral border of the pectorails minor muscle, the cords of the branchial plexus form large terminal branches. The axillary, musculoctaneous, and medial brachial cutaneous nerves branch from the brachial plexus proximal to the location in which local anesthetic is deposited during an axillary nerve block, and thus are usually spared. At this level, the major terminal nerves often are separated by fascia, therefore multiple; injections (10-mL each) may be required to reliably produce anesthesia of the entire arm distal to the elbow.

There are few contraindications to axillary brachial plexus blocks. Local infection, neuropathy, and bleeding risk must be considered. Because the axilla is highly vascularized, there is a risk of local anesthetic uptake through small veins traumatized by needle placement. The axilla is also a suboptimal site for perineural catheter placement because of greatly inferior analgesia versus an infraclavicular infusion, as well as theoretically increased risks of infection and catheter dislodgement.

All of the numerous axillary block techniques require the patient to be positioned supine, with the arm abducted 90^0 and the head turned toward the

contralateral side. The axillary artery pulse should be palpated and its location marked as a reference point.

A. Transarterial Technique :

This technique has fallen out of favour due to the trauma of twice purposefully penetrating the axillary artery along with a theoretically increased risk of inadvertent intravascular local anesthetic injection. The nondomiant hand is used to palpate and immobilize the axillary artery, and a 22-aguaue needle is inserted high in the axilla until bright red blood is aspirated. The needle is then slightly advanced until blood aspiration ceases. Injection can be performed posteriorly, anteriorly, or both locations in relation to the artery. A total of 30 – 40 mL of local anesthetic is typically used.

B. Nerve Stimulation

Again the non-dominant hand is used to palpate and immobilize the axillary artery. With the arm abducted and externally rotated, the terminal nerves usually lie in the following positions relative to the artery, (Fig. although variations are common): median nerve superior (wrist flexion, thumb opposition, forearm pronation); ulnar nerve inferior (wrist flexion, thumb adduction, fourth / fifth digit flexion); and radial nerve inferior – posterior (digit / wrist / elbow extension, forearm supination). The musculocutaneous nerve (elbow flexion) is separate and deep within the coracobrachials muscle, which is more superior (lateral) in this position and, as a consequence, is often not blocked with this procedure (Fig.). A 2-in., 22-guage insulated needle is

inserted proximal to the palpating fingers to elicit muscle twitches in the hand. Once an acceptable muscle response is identified, and after reducing the stimulation to less than 0.5 mA, careful aspiration is performed and local anesthetic is injected. Although a single injection of 40 mL may be used, greater success will be seen with multiple nerve stimulations (ie, two or three nerves and divided doses of local anesthetic.

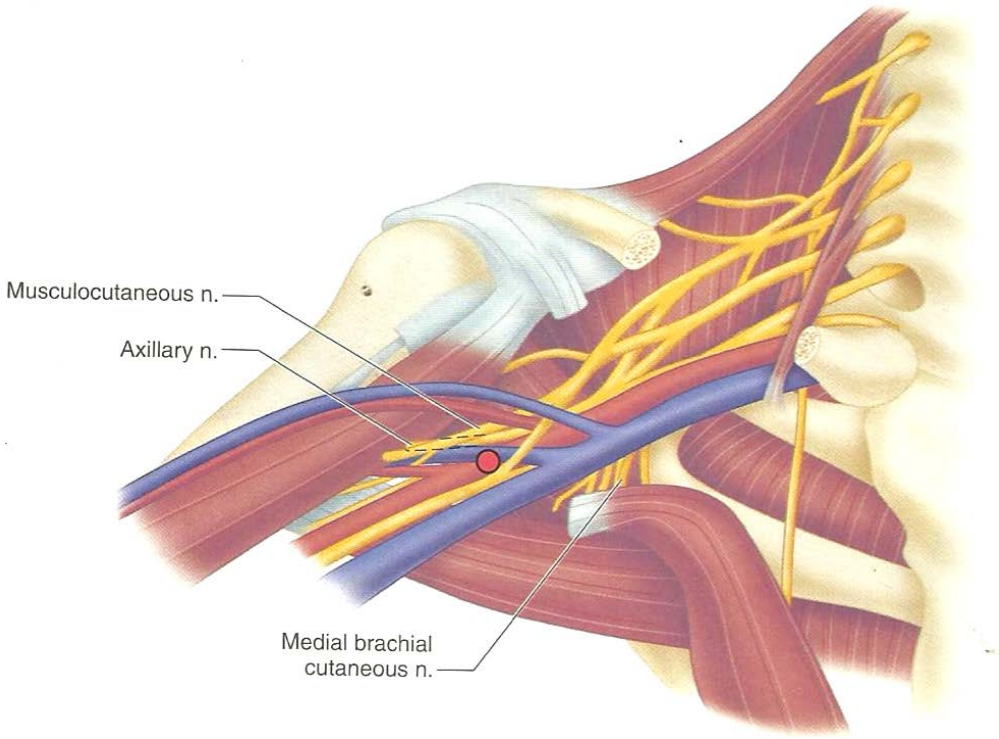


Fig.4. Axillary Block. The axillary, musculocutaneous and medial brachial cutaneous nerves are usually spared with an axillary approach.

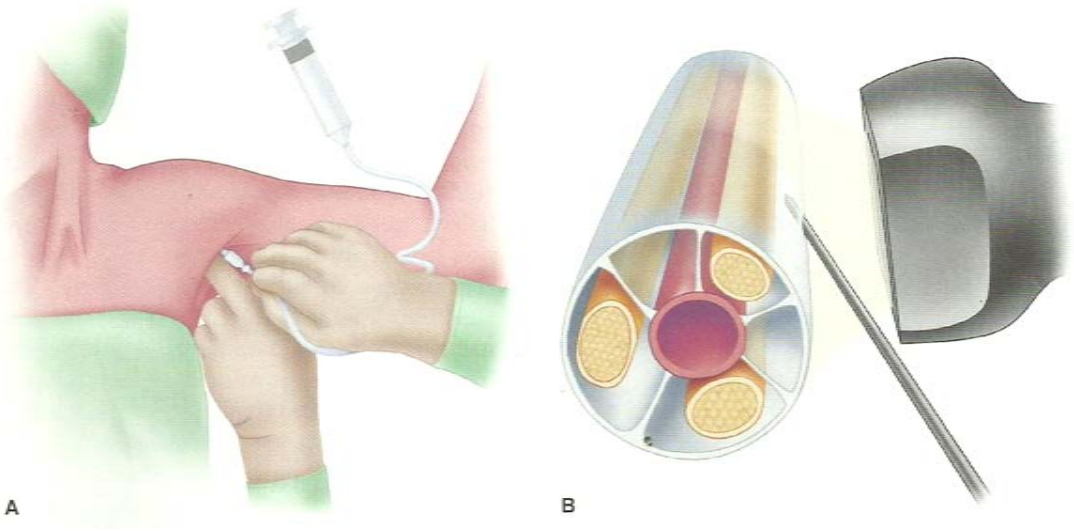


Fig 5. A : Patient positioning and needle angle for axillary brachial plexus block.

Fig 5. B : A multiple technique is more effective because of fascial separation between nerves.

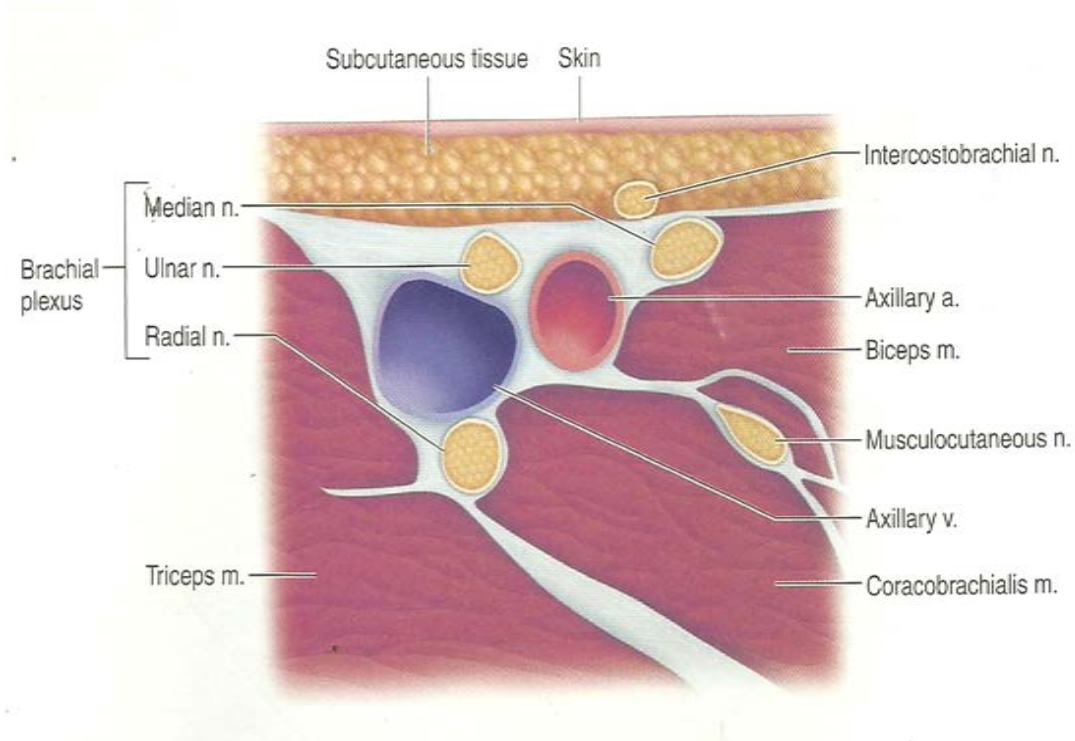


Fig.6. Positioning of terminal nerves about the axillary artery (variations are common).

1. Nerve Stimulation :

With the patient positioned supine, a line is drawn along the inguinal ligament, from the anterior superior iliac spine to the public tubercle. A second line is drawn parallel to the first that traverses the greater trochanter (intertrochanteric line). Next, these two lines are connected with a third line drawn from the point between the medial one third and lateral two thirds of the first line, at 900 angle, and extended caudally to intersect with the intertrochanteric line. A long (10 to 15 cm needle is inserted through this intersection and directly posterior until foot inversion of plantarflexion is elicited (dorsiflexion is acceptable for postoperative analgesia). Often with this approach, the femur is conducted before the needle reaches the sciatic nerve. When this occurs, the needle should be withdrawn 2 – 3 cm, the patient should be asked to internally rotate the leg, and then the needle should be advanced. If the femur is contacted again, the landmarks may require reassessment. A local anesthetic volume of 25 mL provides surgical anesthesia.

PHYSIOLOGY OF PAIN[18]

Pain was called by Sherrington, “The physical adjunct of a imperative protective reflex to painful stimuli which generally initiate potent withdrawals and avoidance response”.

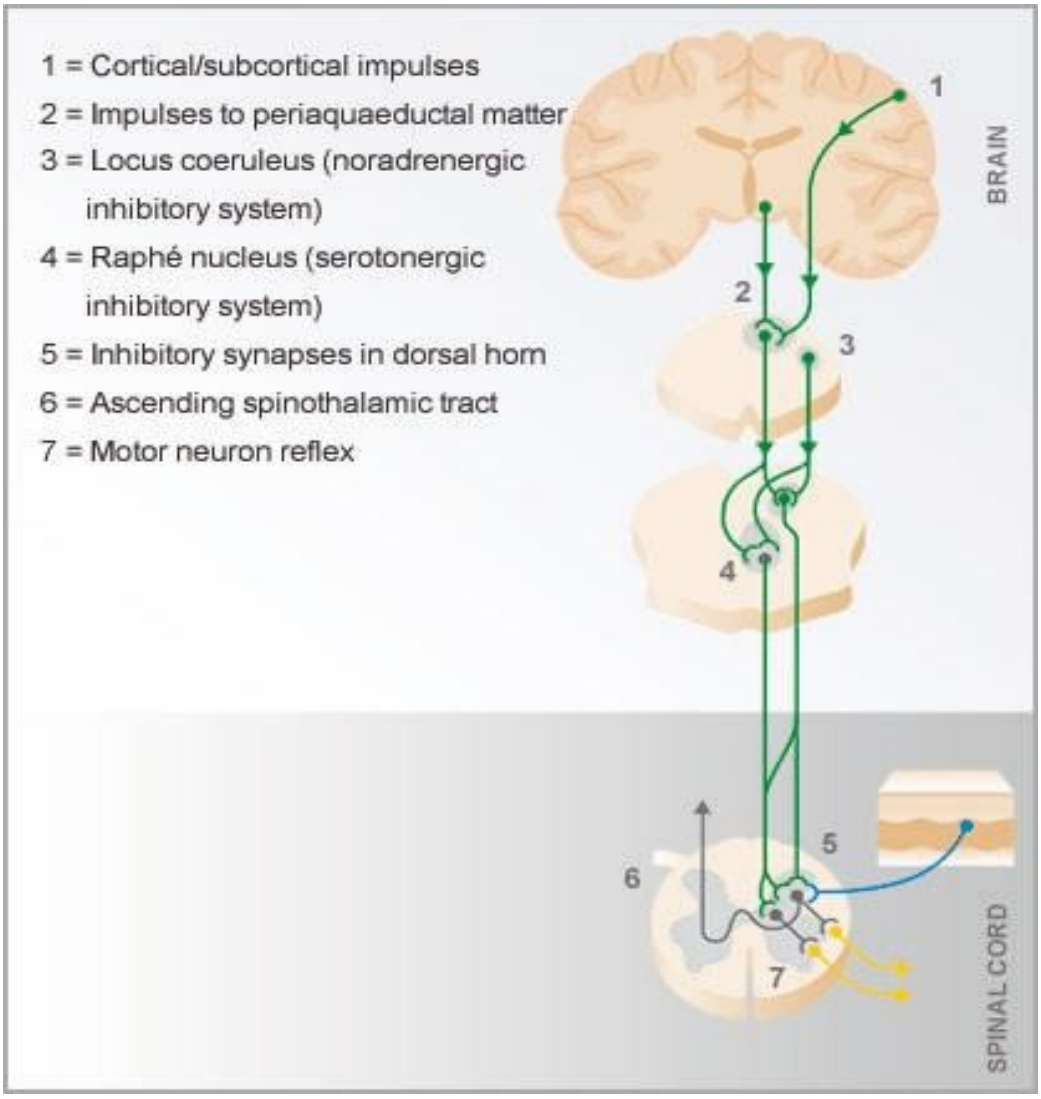


Fig 7. Illustration of Pain Pathway

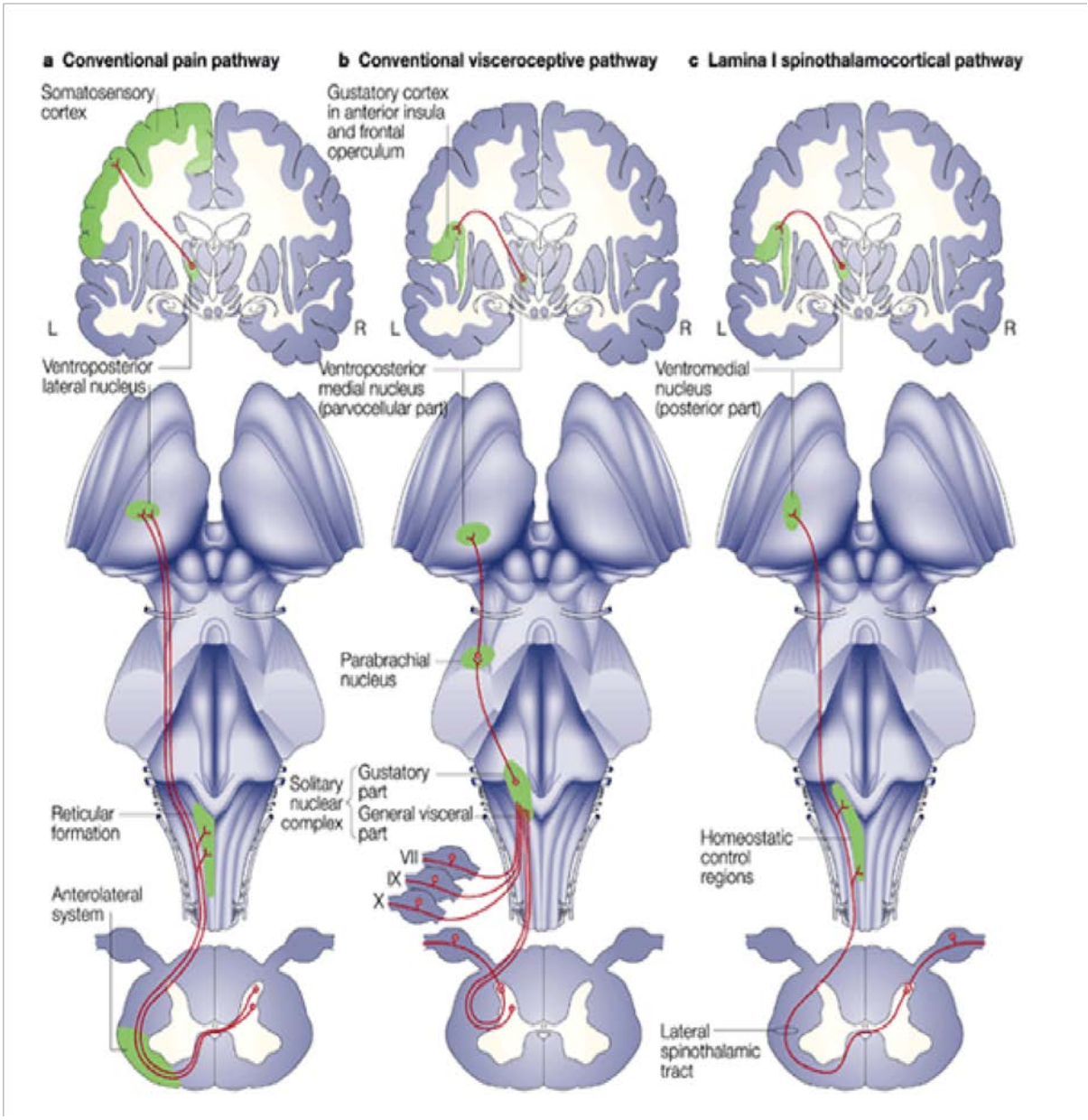


Fig 8.Types of Pain Pathway

Pain is defined by the international association of study of pain “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.

Pain is classified as fast and slow a painful stimuli causes bright sharp localized sensation (fast pain) followed by dull intense, diffuse, and unpleasant feeling (slow pain) evidence suggest that fast pain is due to activity in AD fibers, where as slow pain is due to the activity in the C fibers.

Pain is classified as
- Physiological or actuate pain
- Pathological pain or chronic pain

Acute pain typically has a sudden onset and recedes during healing process. Acute pain can be considered as good pain as it serves an important protective mechanism. Chronic pain can be considered as bad pain because it persists long after recovery from injury and is often refractory to common analgesic agents including non-steroidal anti inflammatory drugs and opiates chronic pain can result from nerve injury (neuropathic pain) including diabetic neuropathy, toxin induced nerve damage, and ischemia.

Deep pain:

The main difference between superficial and deep sensitivity is the different nature of pain evoked by noxious stimuli. This probably due to a relative deficiency of act nerve fibers in deep structures, so there is little rapid, bright pain. In addition deep pain and visceral pain are poorly localized, nauseating and frequently associated with sweating and changes in blood pressure.

Visceral Pain :

In addition to being poorly localized, unpleasant and associated with nausea and autonomic symptoms visceral pain often radiates and is referred to other areas.

The autonomic nervous system like the somatic has afferent component, central integrating stations, and effecter pathways. The receptor for pain and the other sensory modalities present in the viscera are similar to those in skin, but there are marked differences in their distribution.

There are no proprioceptors in the viscera, and few temperature and touch receptors and nociceptor are present although they are more sparsely distributed than in somatic structure.

FUNCTIONAL ANATOMY

The brachial plexuses supplies innervations to the upper limb which consists of a branching network of nerves derived from the anterior Rami of the lower four cervical and the first thoracic spinal nerves starting from their origin and descending distally, The component of the plexus named Roots, Trunks, Divisions, Cords, and finally terminal branches. Five Roots of the cervical and the first thoracic spinal nerves (antertior rami) give rise to three trunks (superior, Middle and inferior) that emerge between medial and antertior scalene muscles to lie on the floor of the postertior triangle of the neck. The roots of the plexus lie deep to the prevertebral facia, Where as the trunk is covered by its lateral extensions, The divisions combine to produce three cords,

Which are named lateral, Medial, and Posterior according to their relationship to the axillary artery from this point on, individual nerves are formed as these neuronal elements descend distally.

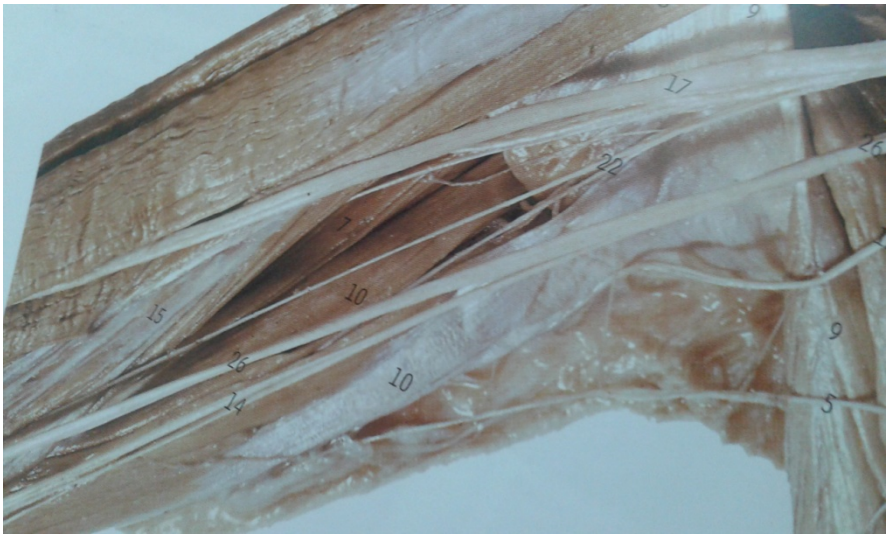


Fig. 9. Anatomy of brachial plexuses in a dissected Arm

Table 1 : Distribution of the brachial Plexuses :		
Nerve (S)	**Spinal Segment(S)**	**Distribution**
Nerve to Subclavius	C5, C6	Subclavius Muscle
Dorsal Scapular N	C5	Rhomboid Muscle and levator scapulae muscle
Long thoracic nerve	C5 through C7	Serratus anterior muscle
Suprascapular nerve	C5, C6	Subscapularis and teres major muscle
Pectoralis nerve medical and lateral	C5 through T1	Pectrolis Muscle
Subscapular nerve	C5 – C6	Subscapularis and teres major muscle
Thorocodorsal	C6 through C8	Lattisms dorsi muscle
Axillary Nerve	C5 and C6	Deltoid and teres minor muscle, skin of shoulder
Radial Nerve	C5 through T1	Extensor muscle of arm and forearm (triceps branchi, extensor carpiradialis, extensor carpi ulnaris), supinator, anconeus and branchioradialis muscle digital extensors and abductor pollicis longus muscle, skin over the posterola loral surface of arm, forearm, and hand
Musculocutaneous nerve	C5 through C7	Flexor muscle of the arm (bicepsbrachii, brachialis,

		coracobrachials) skin over the lateral surface of the forearm.
Median Nerve	C6 through T1	Flexor Muscle of the forearm (Flexor Carpi radialis, Palmaris longous) Pronator Quadaratus, pronator teres muscle digital flexor (through the palmar Interosseus nerve skin over anterolateral surface of the hand.
Ulnar nerve	C8 and T1	Flexor carpi ulnars muscle, adductor policis muscle the hypothenar muscle and the small digital muscles, skin over the medial surface of the hand.

PHARMACOLOGY [19,37,38,39]

Local anesthetic are drugs that produce reversible conduction blockade of impulses along the central and peripheral nerve pathways .Peripheral nerve block anesthesia is achieved by injection of local anesthetic solution into tissues surrounding individual peripheral nerves or nerve plexuses such as brachial plexuses. When local anesthetic solution is injected into the concentration gradient (Winnio at 91, 1977 b) consequently, Nerve fibers along mantle of the mixed nerve are anesthetized first. These mantle fibers are usually distributed to more proximal anatomic structures in contrast to distal structures innerved by the nerve fibers near the core of the nerve. This explains the initial development of anesthesia proximally, with subsequent distal spread as local anaesthetic solution diffuses to reach the more central core fibers conversely recovery of sensation occurs in reverse directions. So that sensation returns initially to the proximal and last to the distal parts of the limb.

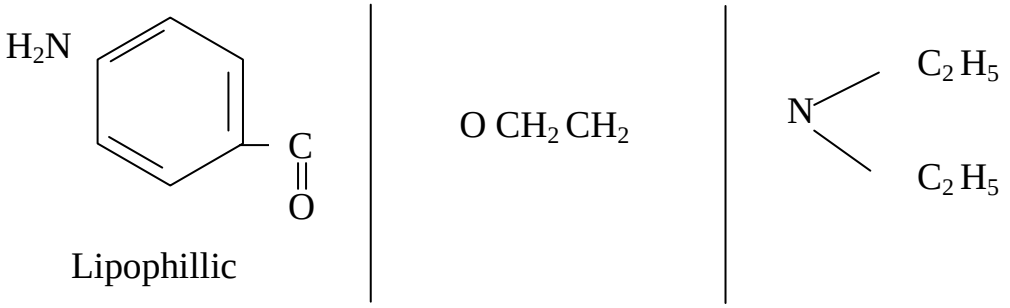
Skeletal muscle paralysis may precede the onset of sensory anaesthesia, If motor nerve fibers are distributed peripheral to the sensory fibers in the mixed peripheral nerves indeed, The sequence of onset and recovery from the blockade of sympathetic, sensory and motor nerve fibers in a mixed peripheral nerve depends as much nerves as on their sensitivity to local anaesthetics. This differs from results of invitro studies on single nerve fibers. In which diffusions does not play a role. In an invitro model, Nerve fiber size is most important, with the onset of conduction blockade being inversely proportional to fiber

size. For example the smallest sensory and autonomic nervous system fibers are anesthetized first, followed by larger motor and proprioceptive axons. The rapidity of onset of sensory anesthesia after injection of a local anesthetic solution into tissue around a peripheral nerve depends on pk_a of the drug, The pk_a determines the amount of local anesthetics that exists in the active non ionized form at the pH of the tissues, For example The onset of action of lidocaine occurs approximately 15 minutes, reflecting the greater fraction of lidocaine that exist in the lipid soluble non ionized form The onset and duration of sensory anesthesia for brachial plexus block produced by 0.5% bupivaicaine, Levobupivacaine or ropivacaine is similar.

Duration of peripheral nerve blockade depends on the dose of local anesthetic, its lipid solubility, its degree of protein binding and concomitant use of vasoconstrictor such as epinephrine. The duration of action is prolonged more safely by epinephrine than by increasing the dose of local anesthetic, which also increase the likelihood of systemic toxicity. Bupivacaine combined with epinephrine may produce peripheral nerve block anesthetic lasting upto 14 Hours. Conversely not all reports documented a prolongation of the duration of action when epinephrine is added to bupivacaine or ropivacaine.

STRUCTURE RELATED ACTIVITY OF LOCAL ANESTHETICS.

Local anesthetic consists of a lipophillic and a hydrophillic portion separated by connecting a hydrocarbon chain.



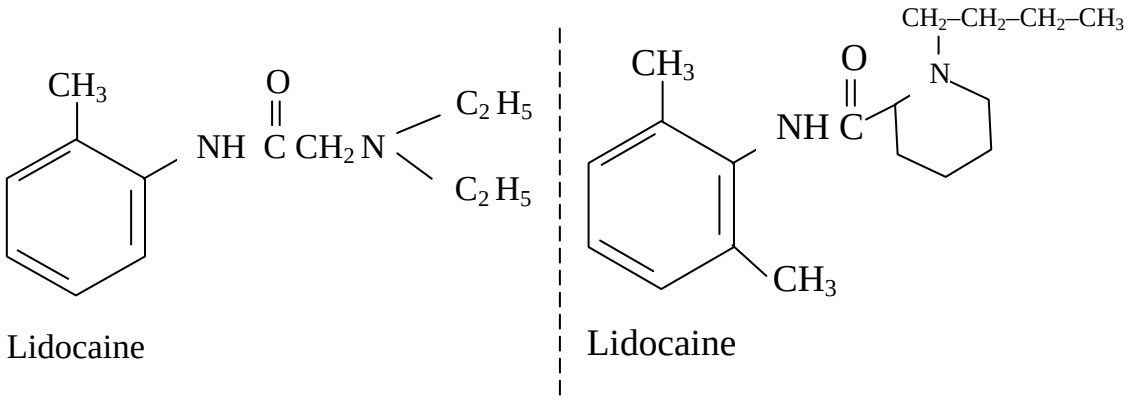
Hydrophillic is usually a tertiary amine such as diethylamine where as lipophillic portion is usually an unsaturated aromatic ring, Such as para amino benzoic acid. The lipophillic portion is essential for anesthetic activity and therapeutically useful local anesthetic require a delicate balance between lipid solubility and water solubility in almost all instances, an ester (-co-) or an amide (-NHC-) bond links the hydrocarbon chain to the aromatic rings. The nature of this bond is the basis for classifying drugs that produced conduction blockade of nerve impulses as an ester local anaesthetic or amide local anaesthetics. The important differences between ester and amide local anaesthetic relate to the site of metabolism and the potential to produce allergic reactions.

Modification of Chemical Structures

Modifying the chemical structure of a local anaesthetic alters its pharmacological effects. For example, lengthening the connecting hydrocarbon chain or increasing the number of carbon atoms on the tertiary amine or

aromatic ring often results in local anesthetic with different lipid solubility, potency, rate of metabolism and duration of action. Indeed, substituting a butyl group for amide group results in tetracaine compound with procaine, Tetracaine is more lipid soluble, is ten times more potent, and has a longer duration of action corresponding to a four to five fold decrease in the rate of metabolism.

Structure of Lidocaine



CLASSFICATION OF LOCAL ANAESTHETICS

Esters	Amides
Procaine	Lidocaine
Chlaroprocaine	Etidocaine
Tetracaine	Prilocaine
	Mepivaicaine
	Bupivacaine
	Levobuvacaine

MECHANISM OF ACTION

Local anesthetic prevents transmission of nerve impulse (Conduction Blockade) passage of sodium ions through ion-selective sodium channels in nerve membranes. The sodium channel itself is a specific receptor for local anesthetic molecules. Occlusion of open sodium channels by local anesthetic molecules contributes little to over all inhibition of sodium permeability. Failure of sodium ion channel permeability to increase, slows, the rate of depolarization such that threshold potential is not reached and thus an action potential is not propagated. Local anaesthetic do not alter the resting transmembrane potential or threshold potential

SODIUM CHANNELS

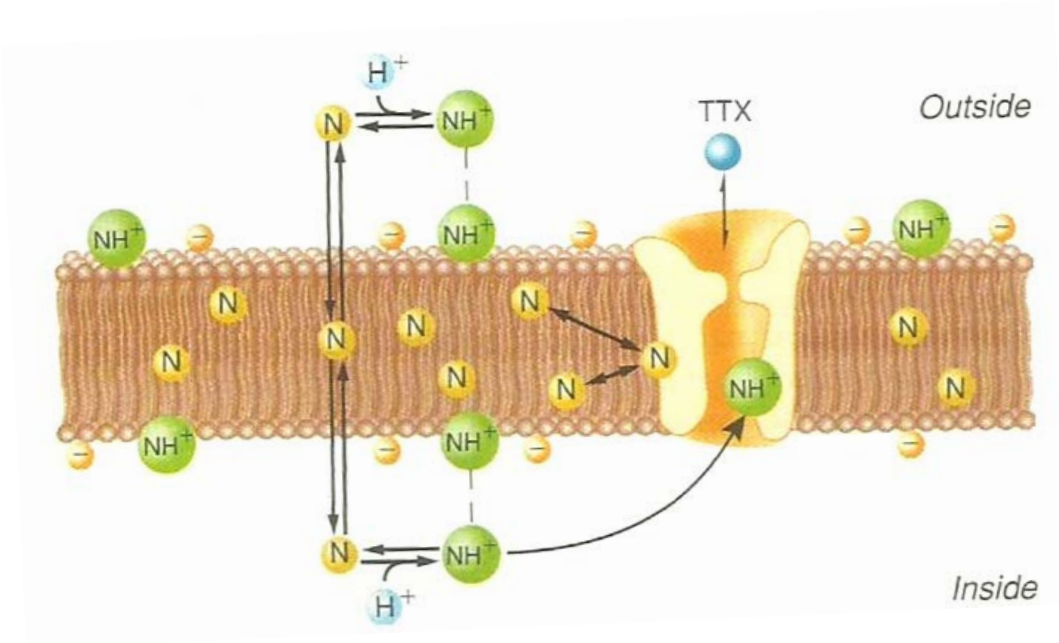


Fig. 10. Sodium Channels

The sodium channel consists of large sodium-conducting pore (Alpha Subunit) and varying number of adjacent beta subunits. The large polypeptide

that forms the alpha subunit is further divided into four subunits DI-IVH is the alpha subunit is further allows ion conduction and binds to local anesthetics binding to the sodium channel are stero specific and depends on the conformational state of sodium channel. Sodium channels exist in activated open, inactivated-closed and resting closed states during various phases of the action potential. In the resting nerve membrane, sodium channels are distributed in equilibrium between resting closed and inactivated closed states. By selectively binding to sodium channels in inactivated-closed states local anesthetic molecules stabilizes. These channels in this configuration and prevent their change to the rested-closed and activated open states in response to nerve impulses. Sodium channels in the inactivated-closed state are not permeable to sodium and thus conduction of nerve impulses in not propagated. It is speculated that local anesthetics binds to specific sites located on the inner portion of sodium channels as well as obstructing sodium channels near their external open in as to maintain these channels in inactivated closed states. This binding appears to be weak and to reflect a relatively poor fit of the local anesthetic molecule with receptor. This is consistent with broad variety of chemical structures that exhibit local anaesthetic activity on sodium channels.

FREQUENCY – DEPENDENT BLOCKADE

Sodium ion channel tend to recover from local anesthetic induced conduction blockade between action potentials and to develop additional conduction Blockade. Each time sodium channels open during an action potential (Frequency-Dependent Blockade). Therefore, Local anaesthetics

molecules can gain access to receptors only when sodium channels are in activated open state. For this reason, Selective conduction blockade of nerve fibers by local anaesthetics may be related to the nerves characteristic frequency of activity as well as to its anatomic properties. Indeed, a resting nerve is less sensitive to local anaesthetic - induced conduction blockade than is a nerve that has been repetitively stimulated. Etidocaine characteristically blocks motor nerve before sensory nerve because of frequency dependent blockade.

MINIMUM CONCENTRATION

The minimum concentration of local anesthetic necessary to produce conduction blockade of nerve impulses is termed the cm. The cm is analogous to the minimum alveolar concentration for inhaled anaesthetics. Nerve fibers diameter influences cm with larger nerve fibers requiring higher concentration blockade. An increased tissue pH or high frequency of nerve stimulation decreases cm.

Each local anaesthetics has unique cm. reflecting differentials potencies of each drug The cm of the motor fibers is twice of sensory fibers thus sensory anesthesia may not always be accompanied by skeletal muscle paralysis. Despite an unchanged cm, less local anesthetics is needed for subarachnoid anaesthesia than for epidural anaesthesia, reflecting greater access of local anaesthetic to unprotected nerves in subarachnoid space.

Peripheral nerves are comprised of myelinated A and B fibers and unmyelinated C fibers. A minimal length of myelniated nerve fiber must be exposed to an adequate concentration of local anaesthetics for conductions blocked of nerve impulses to occur. For example, if only one node of Ranvier is blocked (site of change in sodium permeability) the nerve impulse can jump (skip) across this node and conduction blockade does not occurs. For conduction blockade to occur in a fiber it is necessary to expose atleast two and preferably three successive nodes of Ranvier to a adequate concentration of both types of pain conducting fibers (myelinated). A delta and non myelinated (fibers) are blocked by similar concentration of local anaesthetics, despite the differences of these fibers. Pregangilonic – B fibers are more readily blocked by local anaesthetics than any fibers, eventhough these fibers are myelinated.

Pharmacokinetics

Local anaesthetics are weak bases that have pka valves somewhat above physiological pH. As a result <50% of local anaesthetics exists in lipid soluble non ionized form at physiological pH. Intrinsic vasodilator activity will also influence apparent potency and duration of action.

Absorption and Distribution

Absorption of local anaesthetics from its site of injection in to the systemic circulation is influenced by the site of injection dosage, use of epinephrine and pharmacologic characteristics of drug. The ultimate plasma concentration of local anaesthetic is determined by the rate of tissue

distribution and the rate of clearance of drug. Lipid solubility of the local anaesthetic is important in this redistribution, as well as being primary determinant of intrinsic local anesthetic potency. After distribution to highly perfused tissues, the local anaesthetic is redistributed to less well perfused tissues, including skeletal muscles and fat. Consideration of cardiac output is important for describing the overall tissue distribution. In addition to tissue blood flow and lipid solubility of the local anaesthetics, patient related factors such as age, cardiovascular status, and hepatic function will also influence the absorption and resultant plasma concentration of local anaesthetics. Protein binding of local anaesthetics will influence their distribution and execution. In this regard protein binding parallels lipid solubility of the local anaesthetics and is inversely related to plasma concentration of the drug. Overall after systemic absorption amide local anaesthetics are more widely distributed in tissues than ester local anaesthetics.

Lung extraction :

The lungs are capable of extracting local anaesthetics, such as lidocaine, bupivacaine and prilocaine from the circulation. After rapid entry of local anaesthetics into the venous circulation, this pulmonary extraction will limit the concentration of drug that reaches the systemic circulation for distribution to the coronary and cerebral circulation. For bubivacaine, this first pass pulmonary extraction is dose dependent, suggesting that the uptake process, became saturated rapidly. Propranolol impairs bupivacaine extraction by the lungs, perhaps reflecting a common receptor site for the two drugs.

Furthermore, propranolol decreases plasma clearance of lidocaine and bupivacaine, presumably reflecting propranolol induced decreases in hepatic blood flow or inhabitation of hepatic metabolism.

Metabolism of amide local anaesthetics :

Amide local anaesthetics undergo varying rates of metabolism by microsomal enzhymes located primarily in the liver. Prilocaine undergoes the most rapid metabolism. Lidocaine and mepivacaine are intermediate and Etidocaine, Bupivacaine and ropivacaine undergo the slowest metabolism among the amide local anaesthetics. The initial step is conversion of the amide base to amino carboxylic acid and a cyclinic anilide derivative. Complete metabolism usually invokes additional steps such as hydroxylation of aniline moiety and idealkylation of amino carboxylic acid compared with that of ester local anaesthetics, the metabolism of amide local anaesthetics is more complex and slower. This slower metabolism means that sustained increases of plasma concentration of amide local anaesthetics and thus systemic toxicity are more, cumulative drug effects of amide local anaesthetics are more likely than with ester local anaesthetics.

Lidocaine

The principal metabolic pathology of lidocaine is oxidative dealkylation in the liver to monoethylglycine xylidide followed by hydrolysis of this metabolic to xylidide. Monoethylglycine xylidide has approximately 80% of the activity of lidocaine for protecting against cardiac dysrhythmias in an

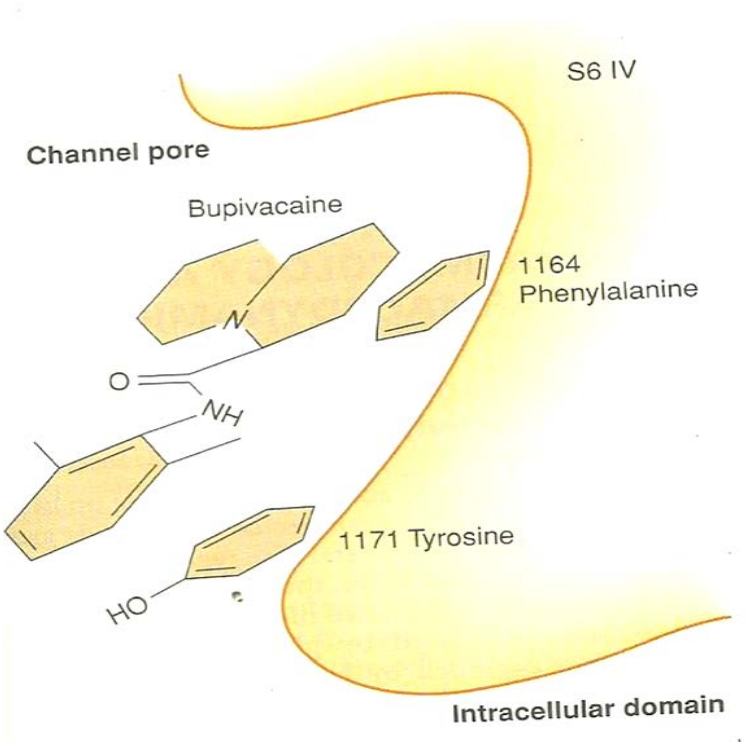
animal model. This metabolite has a prolonged elimination. Half time, accounting for its efficacy in controlling cardiac dysrhythmic after the infusion of lidocaine is discontinued. Xylidide has only approximately 10% of the cardiac antidysrrhythmic activity of lidocaine. In human, approximately 75% of xylidide is excreted in the urine as 4-hydroxy 1-6 dimethylanilide.

Hepatic disease or decrease in hepatic blood flow which may occur during anaesthesia can decease the rate of metabolism of lidocaine. For example, the elimination half time of lidocaine is increased more than fivefold in patients with liver dysfunction compared with normal patients. Decreased hepatic metabolism of lidocaine is anticipated when patients are anaestheized with volatile anaesthetics. Maternal clearance of lidocaine is prolonged in presence of pregnancy included hypertension and repeated administration of lidocaine can result in higher plasma concentrations than in Normotensive parturient.

Bupivacaine

Possible pathway for metabolism of bupivacaine include aromatic hydroxylation, N-dealkylation, amide hydrolysis and amide hydrolysis and conjugation. Only the N-dealkylated metabolite – N desbutyl bupivacaine has been measured in blood or urine after epidural or spinal anaesthesia. The mean total urinary execretion of bupivacaine.

Structure of Bupivacaine



Bupivacaine is an amide type of analgesia drugs. It is a hydrochloride salt of l butyl - N - (2, 6 dimethyl phenyl) Piperidine - 2 - Carboxamide.

- It was synthesized in Sweden by Exenstam and his colleagues in 1957.
- First used clinically by L.J.Telivuo in 1963.
- Pka is 8.2
- Molecular wt-288
- Protein binding-95%
- Lipid solubility-28%
- Elimination half life -210mts.
- Toxic plasma concentration-1.5uglml
- Approximate duration of action-175 mts
- It decreases central venous pressure.

- It causes increases in lower limb blood flow.
- It causes a reduction in incidence of deep vein thrombosis.

Respiratory System

It relaxes bronchial smooth muscle. It causes aphnea due to phrenic and inter costal nerve paralysis on depression of medullary centers.

Gastro Intestinal Tracts

There is an increase in gastro intestinal motility and emptying of the gastric contents are better.

Toxicity

Toxicity is replaced to plasma level of unbound drug and more likely due to an inadvertent intravenous injection. Systemic toxicity reactions primarily involve central nervous system and cardiovascular system. The drug is very stable to acids, alkalis, and repeated autoclaving bupivacaine is 0.5% is the preferred strength. Higher concentration result in greater variability of spread.

Bupivacaine 4 times as potent as lignocaine, hence 0.5% solution is approximately equivalent- to 2% lignocaine. It is more cardiotoxicthan lignocaine which is aggravated by hypoxia, Hypercapnia and pregnancy it causes more sensory than block. It is not recommended for Intravenous regional analgesia.

Duration of effect is between 5 and 16 hours and is one of the longest acting local analgesics, which is related to binding of it the nerve tissues.

The mechanism by which local anesthetics block sodium channel conductance is as follows.

Local anesthetics in the cationic form act on the receptors within the sodium channels on the cell membrane and block it. The local anesthetic can reach the sodium channel either via lipophilic pathways directly across the lipid membrane or through the agronomic plasmic.

Pharmacodynamics

It decreases the cardiac output by decreasing the tone of sympathetic system by slowing the heart rate or by reducing the venous return. It produces a fall in arterial blood pressure but it is relatively slow and sodium very profound is metabolized in the liver.

Uses :

- Spinal anesthesia.
- Epidural anesthesia.
- Caudal anaesthesia.
- Continuous epidural anesthesia.
- Peripheral nerve blocks.
- Infiltration anesthesia.

Site of action	Onset (Minutes)	Duration (Minutes)
Intrathecal	5	90 – 120
Epidural	15 – 20	165 – 225
Brachial Plexus	10 – 20	600

Alphal acid glycoprotein is the most important plasma protein binding site of bupivacaine. The concentration of bupivacaine is increased in many situations such as post operative trauma.

Excretion

It is through kidney 4-10% of the drug is excreted unchanged.

Mode of action.

a) Site of action.
   (i) The spinal nerve rootlet fine nerve filaments having large surface area are exposed to local anesthetics.
   (ii) Posterior and lateral aspects of spinal card.
   (iii) Sodium channel blockade;

They impede sodium ion access to the axon interior by occluding the transmembrane sodium channels thus delaying the process of depolarization and axons remain polarized. It is a non-depolarization.

Pharmacokinetics

It gets absorbed through nerve rootlets and it is rapidly absorbed from the site of injection, but the rate of absorption depends on the vasuclarity and

the presence of vasoconstrictors. Because of high lipid solubility it easily penetrates nerves and vascular tissues. 80-95% of absorbed bupivacaine binds to plasma proteins.

Distribution

- Rapid distribution phase I (α)
- Slow disappearance phase II (β)

Biotransformation

Possible pathways of metabolism of bupivacaine include aromatic hydroxylation and conjugation. Only the N-dealkylated metabolite N-desbutyl bupivacaine has been measured in the blood or urine after epidural or spinal anaesthesia. The blood level required to produce central nerves system toxicity is less than that required to produce circulatory collapse.

Central nervous system toxicity early symptoms are circumoral numbness tongue paraesthesia, and dizziness. Sensory complaints included tinnitus and blurred vision.

Excitatory signs (restlessness, agitation, nervousness, paranoia) often precede, central nervous system depression (slurred speech, drowsiness, unconsciousness). Muscle twitching heralds the onset of tonic clonic seizures. Respiratory arrest often follows. The excitatory reactions are the result of selective blockade of inhibitory pathways. The rate of depolarization in fast conducting tissues purkinje fibers and ventricular muscle is decreased.

Extremely high concentration of the drug causes sinus bradycardia, hypotension, AV block, idioventricular rhythm and life threatening arrhythmias such as ventricular tachycardia, ventricular fibrillations, and cardiac arrest.

TREATMENT OF BUPIVACAINE TOXICITY

CNS Toxicity

Convulsions treated by adequate ventilation with oxygenation and controlled by anti convulsions Diazepam (10-20mg 1.V) repeated if necessaries) or alternatively, thiopental (150-250mg) Intravenously Treatment includes mechanical ventilation and circulatory support and use vasopressor may be indicated.

CVS Toxicity.

If ventricular tachycardia, ventricular fibrillation and cardiac arrest occurred then Bretylium is drug of choice. Phenytoin and amidarone are also used. Usage of 20% lipid emulsion will reduced the toxicity of bupivacaine by binding to it.

REVIEW OF LITERATURE

- "II feld BM, Enneking FK et al., [8] Anestn. Analog 2005, 100 : 1822 – 33 Perineural analgesia which can be used as a ambulatory basis, provided statistically superior analgesia at rest and with activity for 48 – 72 hrs with reduction in risk of nausea and vomiting, but increased risk of motor block, Clinically superior analgesia was apparent at rest for the first 24 hrs and with activity for 48 hours".

- "Aguirre et al., [9] (2012) stated that the most common use of C-PNB is in the peri and post operative period but different indications have been described like treatment of chronic pain such as cancer induced pain, complex regional pain syndrome or phantom limb, The documented benefit strongly depends on the analgesia quality and includes decreasing baseline / dynamic, reading analgesic requirement decrease of post operative joint inflammation and inflammatory markers".

- "Tamosuina R', Gudas R, Karbonskiene A, Marchetiene[10] I studied efficacy of continuous interscalene brachial plexus block with bupivacaine 0.17% for post operative analgesia after shoulder surgery and concluded that bupivacaine showed less pain at rest and in motion than the placebo group except 4 h and 6 h after brachial plexus block, requirement of supplemental analgesia was also lower., Side effects, circulatory and respiratory parameters were comparable in both groups. Satisfaction scores were higher in bupivacaine group".

- "Rawal et al.,[11] 1994 described outpatient perineural infusion using a percutaneous catheter and a small light weight, He described ambulatory perineural infusions in various anatomic locations including paravertebral, interscalene, intersternocleidomastoid, infraclauicular, axillary, psoas compartment".

- "Klein et al[12] provided the first prospective evidence quantifying infusion benefits in 2000, This randomized double – masked placebo – controlled investigation involving subjects undergoing open rotator cuff repair who received an interscalene block and perineural catheter preoperatively and they were randomized to receive either perineural Bupivacaine 0.25% or normal saline postoperatively 10m/hr, Patient receiving perineural placebo averaged 3 on a visual analog pain scale of 0 to 10, compared with 1 for subjects receiving 0.25% Bupivacaine".

- "J.E. Chelly, D. Chisti and A. Fanneii[13] conducted a study in (University of Pittsburgh Medical Centre) says that continuous nerve blocks have proved safe and effective in reducing opiod consumption and related side effects, accelerating recovery and in many patients reducing the length of stay in Hospital. Continuous nerve blocks provides a safer alternatives to epidural analgesia in patients receiving thromboprophylaxsis especially with low molecular weight heparin, and concluded that continuous nerve blocks represents an important therapeutic tool in managing perioperative pain and

trauma pain, They have been proved safe and effective, especially when combined with multimodal approach to pain management.

- Ingo Bergmann, Maximillian Heetfeld, Thomas A Crozier, [14] did a study which was published in central European Journal of Medicine to know whether peripheral nerve block gives greater hemodynamic stability than general anesthesia in ASA III patients undergoing knee orrthroscopy, outpatient with preexisting. Cardiovascular and pulmonary disorders and they concluded that peripheral nerve block provides a more stable hemodynamic course than general anesthesia in ASA III patients.

- Brain et al., in University of California, Sanniego[15] did a research study to determine if the effects of continuous peripheral nerve blocks are influences by the distance of insertion past the needle tip of the perineural catheters concluded that the hip of the needle past 3 - 5cms had better pain score than 0 – 1 cms".

- "Charles Pham-Dang[16] published an article in Regional Anesthesia and pain medicine, they evaluated the efficacy of stimulating catheters that were used for continuous peripheral nerve blocks as a means of immediate verification and confirmation of correct catheter position. The intensity of current used to elicit motor responses typically was higher with the catheter than with the introducer needle and thus concluded that the ability to electro stimulate nerves using an insitu catheter increases success in catheter placements for continuous peripheral nerve blocks".

AIM OF THE STUDY

Aim

"To compare the efficacy of continuous peripheral nerve blocks over single shot peripheral nerve blocks (S-PNB), in upper limb orthopedic surgeries."

Primary Objective

This randomized comparative study is to determine whether the post operative pain relief incidence of Break through pain and requirement of rescue analgesia is reduced as published in literatures.

Secondary Objectives :

1. Effectiveness of pain relief at mobilization.
2. Supplemental analgesia, if used
3. Time to mobilization
4. Patients's satisfaction
5. Length of stay in Hospital

MATERIALS AND METHODS

Study design

This was a single centre, prospective, randomized, non blinded comparative study conducted in the department of Anesthesiology. Tirunelveli Medical College, Tirunelveli from June 2015 to August 2015.

After obtaining our College Ethical Committee approve 60 adult patients of both sexes, within the age group of 10 to 60 years. Belonging to ASA 1&2 undergoing orthopedic surgeries upper limbs were selected. They were randomized using computer generated random numbers and allocated into two groups, Groups SS and CS.

Group SS: Received single shot peripheral nerve blocks.

Group CS: Received continuous peripheral nerve blocks.

Study population

Inclusion criteria

1. Age 10 to 60 years
2. ASA 1 and 2
3. Elective cases posted for upper limb orthopedic surgeries
4. BMI < 30 kg/m^2

Exclusion Criteria

1. Infection near the site of Insertion.
2. Coagulation disorders.

3. Known allergy to local anesthesia.
4. Prior surgeries at the site of nerve block.
5. Pregnancy & lactation.
6. Known hepatic or Renal Insufficiencies.
7. Pre-existing neurological deficit of operated upper limb.
8. Any abnormal shoulder anatomy.
9. Patients refusal.
10. Patients request for General anaesthesia.

Sample Size is 60 patients, 30 patients in group SS and 30 patients in Group CS.

Pre operative Evaluation

In patients

Age

Sex

Body weight in kgs

Height in cms

Body mass index kg / m^2

Baseline parameters were recorded.

History regarding

- Previous anaesthesia, surgery.
- Any significant medical illness.

- Medications.
- Allergies were recorded

Following laboratory investigations done.

- Haemoglobin %
- Blood Sugar & Urea
- Serum creatinine
- Urine analysis
- Chest X-ray and ECG
- Bleeding time and clotting time
- Screening for HIV, HBsAg.

Study Method

After getting approval from the institutional ethical committee informed written consent were obtained from the patients. The patients were randomly allocated into groups 2 according to computer generated random numbers.

Preliminaries

1) For the procedure

- A portable tray covered with sterile towels containing Syringes of 10 ml, 2 ml.
- Hypodermic needle of 1 cm length 22 G.
- Povidone iodine and spirit.
- Sponge holding forceps.
- Towel clips

- Sterile Gauze

2) For emergency resuscitation

- The anesthesia machine which is working
- Emergency O2 supply
- Pipeline O2 supply
- Working laryngoscopes
- Appropriate size ET – 6.5, 7, 7.5, 8
- Working suction apparatus
- intravenous fluids
- Drugs Thiopentone, diazepam, succinyl choline, Hydrocortisone, Atropine, Adrenaline, Aminophylline, mephenteramine, calcium gluconate and sodium bicarbonate.

3) Monitors :

- Pulse Oximeter
- Non invasive blood pressure monitored by sphygmomanometer.
- Sphygmomanometer

Premedication given with injection atropine at a dose of 20 µg / kg intra muscularly 3/4th hour before surgery 1.v cannula with 18 G Needle secured in contralateral arm. Ringer lactate is started. Standard monitors according to ASA guidelines were used. Heart rate, mean arterial pressure and SPO2 were recorded before surgery and at regular intervals after the surgery.

Procedure for single shot peripheral nerve block [20,21,22]

A) Supraclavicular

1) Patient lies supine, arms by the side and head turned to slightly opposite side.

a. Identify the interscalene groove and mark the midpoint of clavicle. With strict aspectic precautions the groove between scalene medius and scalene anterior known as interscalene groove is identified. First, finger is insinuated behind posterior border of sternocleido mastoid muscle, which is marked as first groove, finger rolled out little lateral and then palpated second groove which is interscalene groove. A midpoint of clavicle is made a point of around 2 cms above that point sub clavian artery is palpated. A skin wheal is raised just cephalo posterior to the artery then a 22 G 5 cm needle mounted on a 20 ml syringe was passed through the same point parallel to the head and neck, caudally and medially and posteriorly, until the paraesthesia could be elicited, After confirmation with negative aspiration of the blood 40 ml of mixture containing 20 ml of 0.5% Bupivacaine and 20 ml of 2% lidocaine given making sure that the amount of drug does not exceed the toxic dose calculated for that patient. Patient's HR, MAP, SPO2 monitored during and after surgery.

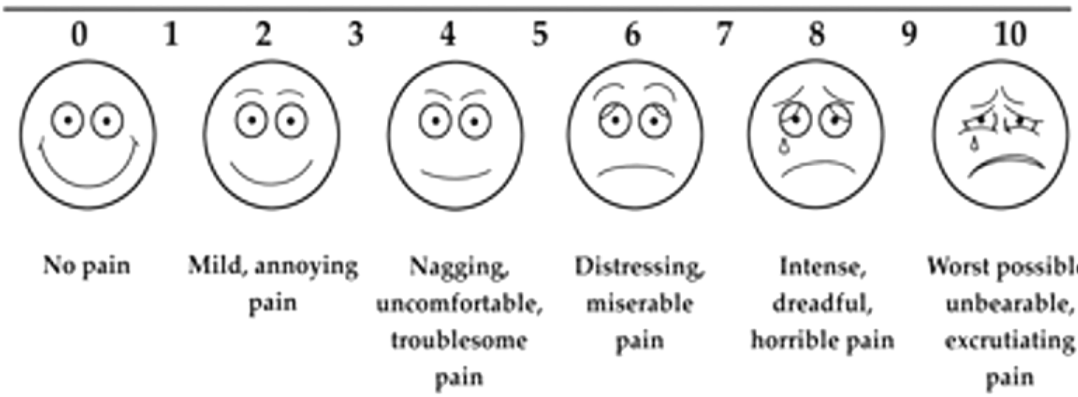
1. VAS Score Calculated for 1h, 2h, 6h, 12h, 24h, 48h postoperatively.
2. Break through pain complained during 48 hours postoperative period is recorded.

3. Rescue Analgesia given during this period is recorded.
4. Opiod related side effect, if occurs recorded.

b. **Interscalene Block**[23,24,25,26] **:** Palpation of the interscalene groove is done with patient lying supine and head rotated to approximately 20 to 25^0 to contralateral side. The external jugular vein often crosses the interscalene groove at the level of cricoid cartilage, Needle is inserted medially and at caudal angle, advanced to elicit paraesthesia after negative aspiration of blood 20 ml of 0.5% Bupivacaine and 20 ml of 2% lidocaine with adrenaline (2,00,000 dilution) making sure that the dose does not exceed the toxic dose calculated for that patients.

c. **Axillary Block**[27,28,29] **:** Patient is positioned supine with arm abducted to 90^0 and head turned to contralateral side. The axillary artery pulse is palpated and location is marked. Two needle passed and a 20 ml of 40 ml of mixture containing (20 ml of 0.5% Bupivacaine + 20 ml of 2% lidocaine given), making sure that the dose does not exceed the toxic dose calculated for that patients.

VAS score, break through pain, and rescue analgesia assessment done as for supraclavicular written above.



Visual analogue scale (pain scale) usually respondents are asked to report current pain intensity in the last 48 hours.

The pain visual analogue scale is self completed by the respondents. The respondent is asked to place a line perpendicular to the VAS line at that point that represents their pain intensity. After the patient has marked, using a ruler, the score is determined by measuring the distance on the 10 cm line between the “No Pain” to severe pain.

The score can be 0 – 10. A higher score indicates greater pain intensity. Based on the distribution of the pain, VAS score in the post surgical patients, the following cut points on the pain VAS have been recommended.

- No pain (0 – 1)
- Mild pain (2 – 4)
- Moderate pain (5 – 7)
- Severe pain (8 – 10)

Significance of visual analog scale :

Pain visual analogue scale is very easy to be used by respondent and assessor both. Woodford and Museky first reported use of VAS pain score. The reliability of the test has shown to be good and is higher among literate.

Definition of Break through pain :

Break through pain :

Discomfort, usually acute severe which is experienced by patients between the normal doses of medications that generally controls or palliates such pain.

Definition of Rescue analgesia :

Rescue analgesia agents are medications prescribed in addition to regularly scheduled analgesic medications, which are intended to be taken during episodes of pain not controlled a patients scheduled analgesic regimen.

Procedure of Continuous Perineural Block[30,31,32,33,34,35]

Drugs and other equipments for the block procedure must be readily available in the room and prepared at bedside. Adverse effects and complication of peripheral nerve are reliably rare. However they do occur, immediate and acute invention is necessary to prevent serious complications. All drugs were neatly organized and made immediately accessible to us. Emergency drugs like atropine, adrenaline and propofol were made available to me throughout the procedure. For each patient, an i.v access with 18G needle is secured, supplemental oxygen was given, ECG monitoring was instituted,

when low intensity current nerve stimulation and slow nerve advancement was used. Interscalaene brachial plexus block was done with minimal patient discomfort. 1-3 mg of midzolam were given to most patients and make them co-operative during nerve localization following needle advancement as described below 30 ml of 0.25% of bupivacaine is injected, and a contiplex d catheter was used. With needle over technique and tip of the catheter passed beyond 3cms the needle tip and then. Tunnelling [42,43,44] was made to prevent slippage of catheter. At the site of exist of the catheter. Tuoh's needle is inserted and stillet removed, catheter passed retrogradely and then removed at the point of exists and catheter fixed at the neck. Total duration of the technique is also recorded catheter is connected to a portable infusion pump in the PACU with Infusion regimen of 0.125% bupivacaine 5ml/hr with lock out period of 60 minutes[40,41] and the following is observed.VAS score at 1hr, 2hr, 6hr, 12hr, 24hr, 24hr post operatively. With VAS scare ranging from 0 to 10. No pain and 10 unbearable distresses. After 48 hours, removal of the catheter done and patient shifted to orthopedic post operative ward.

TECHNIQUE OF INTERSCALENE NERVE BLOCK

In our study, Meire anterior approach is followed where the needle is inserted at the level of the superior thyroid notch along the posterior edge of the steno cleidomastoid muscle. The puncture was directed caudally slightly to the lateral side and aimed at the direction of Ipsilateral nipple. This technique has lower risk of inadvertent vessel puncture. Since this technique has lower risk of inadvertent artery puncture.

Fig. 11 Anatomical Handmark of Interscalene Block

Fig. 12 Puncture site of interscalene block

"The patient lyed supine, the arm to blocked is positioned comfortably on the abdomen and head turned away to contralateral side. Patient is asked slightly to elevate the head in order to make steno cleido mastoid muscle prominent. Care should be taken for the external jugular vein, which commonly exists in this area. After preparing the skin an antiseptic solution, and draping our field. A skin wheal is created at the site of puncture of 2% lidocaine with 2,00,000 dilution adrenaline. A stimuplex D55mm 15 level, 22G conducting needle is used and connected to stimulator with current strength of 1mA. Pulse duration of 0.1 ms pulse frequency of 2Hz mounted to a 10 ml syringe with 0.25% Bupivacaine + 2% lidocaine mixture.

The direction of insertion is caudal, however, with discreet dorsal orientation relative to the body axis contraction in the region of biceps brachii. While montoring the stimulatory response, we reduced the stimulation current

of 0.2-0.3 MA is reached. If the stimulatory response is still trigerred, the needle must be retracted slightly. If visible muscle contractions occur and negative aspiration test done the local anesthetic injected slowly.

TECHNIQUE OF SUPRACLAVICULAR BLOCK

The technique is similar to interscalene block except the anatomical landmark and the puncture site.

Anatomical Land Mark

1. Clavicle
2. Postertior Border of clavicle
3. Inter scalene groove is marked as described in single shot technique.

   Palpation of the subclavian artery is done.

Puncture site is 1 cm superior to the junction of medial 2/3rd and lateral 1/3 of clavide, just behind subclavian artery. The stimulating needle is directed posterior, caudal and lateral to subclavian artery, 1 cm above the point marked in the clavicle as shown in the figure in single shot catheters. Tunnelling is done as described in interscalene technique.

The catheter fixation and other measure are as above.

Technique of axillary block.

Anatomical land mark.

a) palpate the axillary
b) a Needle above the artery in Axilla high above.

c) Needle is passed high above the axilla at the axillary course, directing the needle posterior.

VAS Score, Break through analgesia, and rescue analgesia is recorded as done for interscalene block. Protocol followed for supraclavicular and axillary block is same as interscalene block as described above.

Fig. 13. Comptipelex D Catheter

Fig. 14. Nerve stimulator

RESULTS & ANALYSIS

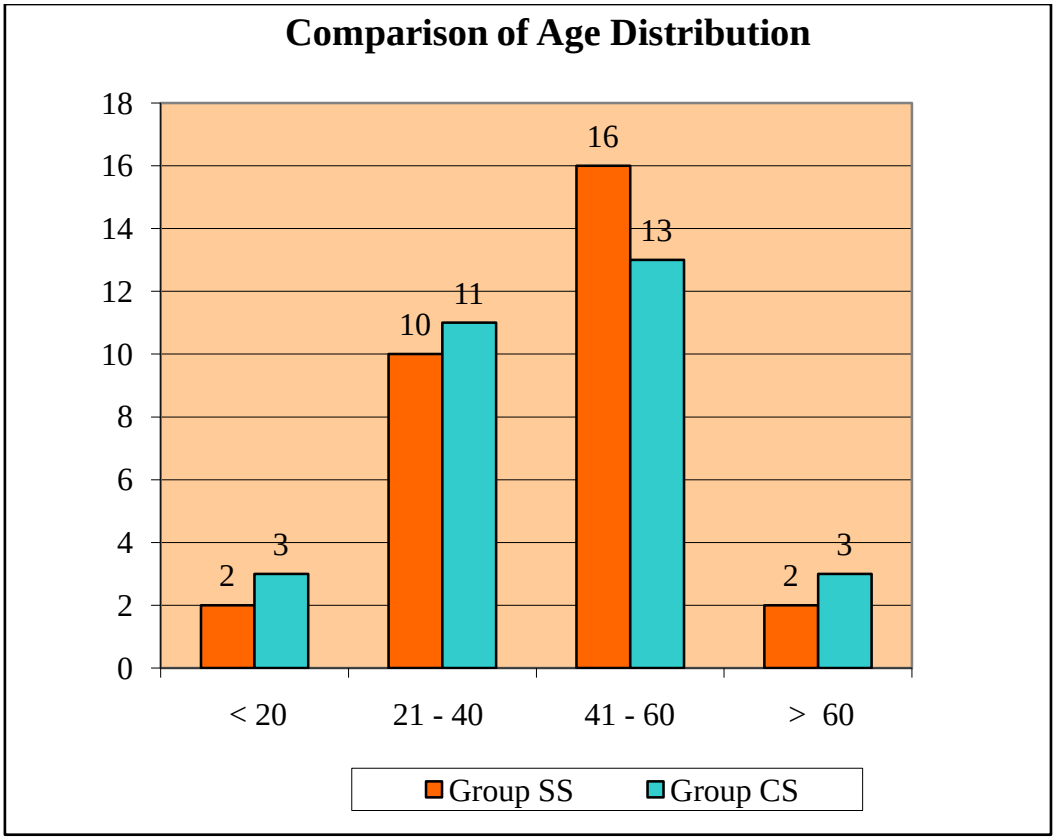
Statistical Analysis :

Data analysis was done with the help of computer by using SPSS software and Sigma Stat 3.5 version (2012). Using this software percentage, mean, standard deviation and ‘p’ value were calculated through one way ANOVA, and Chi square test and P value of < 0.05 was taken as significant.

TABLE 2. AGE DISTRIBUTION

Age in years	Group SS	Group CS
< 20	2	3
21 - 40	10	11
41 - 60	16	13
> 60	2	3
Total	30	30
Mean	43.6	43.2
SD	14.5	15.5
p value	0.918 Not significant	

Chart 1. AGE DISTRIBUTION

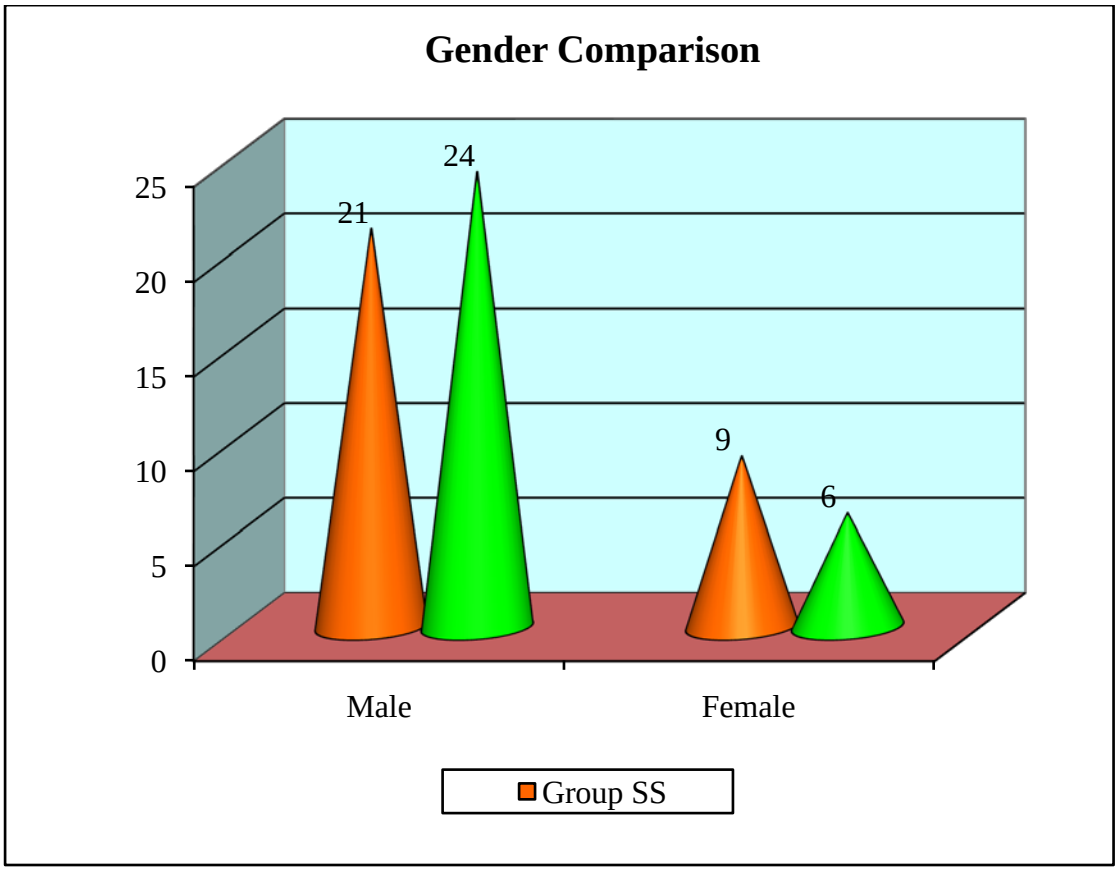


The mean age in group SG is 43.6 and in group CS is 43.2, and p valve is >0.005 so not significant so comparable.

TABLE 3 : GENDER COMPARISON

Gender	Group SS	Group CS
Male	21	24
Female	9	6
Total	30	30
p value	0.888 Not significant	

CHART 2 : GENDER COMPARISON

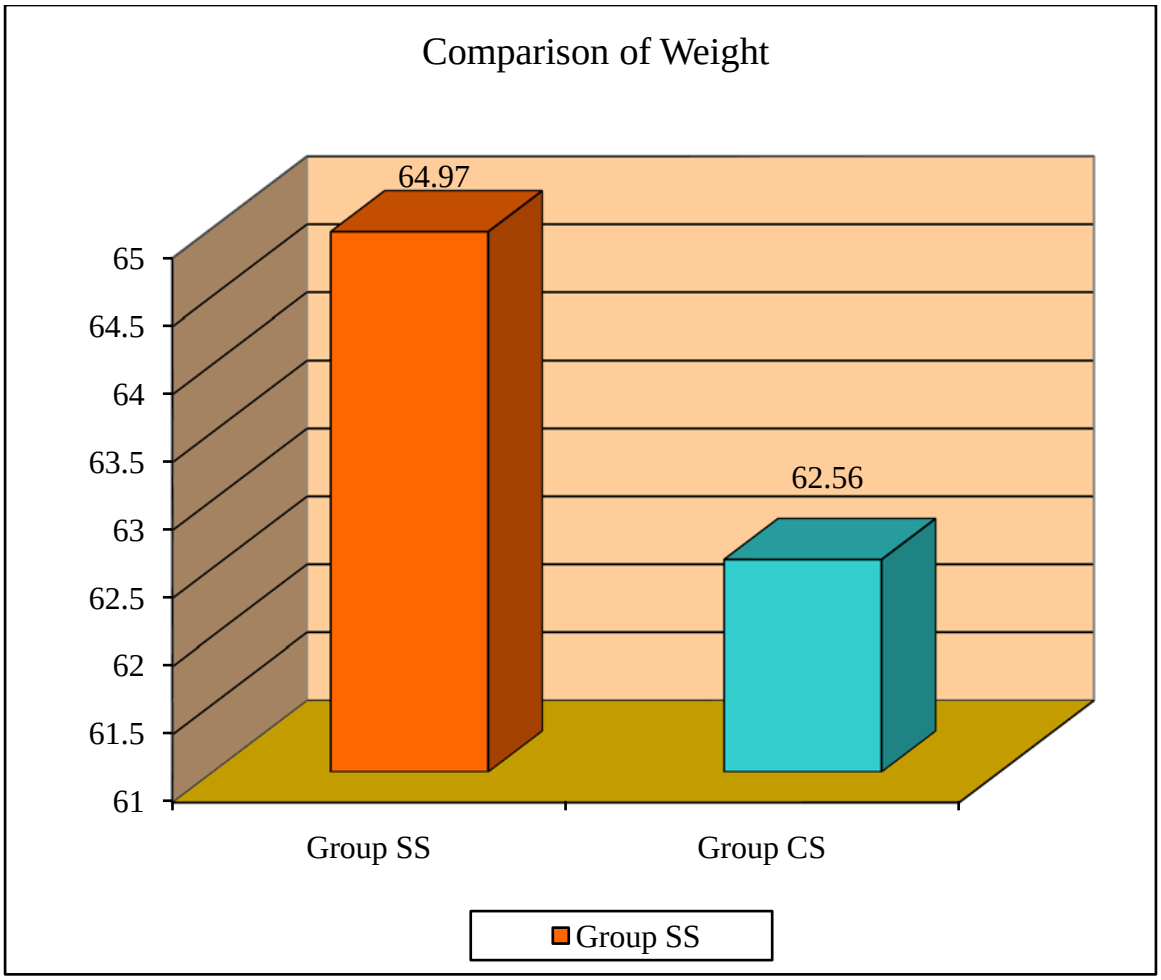


The no of males in group SS and CS are 21and 24 respectively and female in both groups are 9 and 6 respectively and p valve is >0.005 not significant, so both groups are comparable.

TABLE 4 : COMPARISON OF WEIGHT

Weight	Group SS	Group CS
Mean	64.97	62.56
SD	14.13	13.27
p value	0.511 Not significant	

CHART 3 : COMPARISON OF WEIGHT

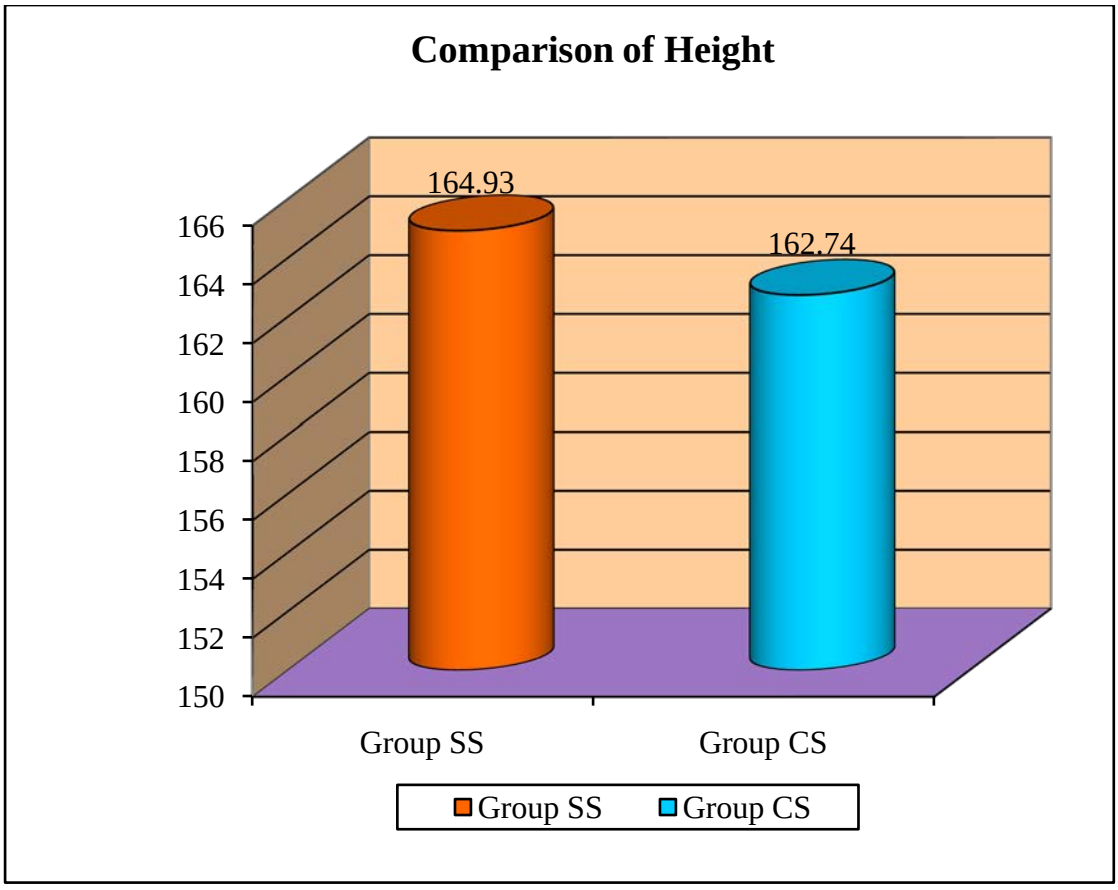


The Mean weight in group SS is 64.9 kg and in CS group is 61.56, and p valve >0.005 not significant, so both groups are comparable.

TABLE 5 : COMPARISON OF HEIGHT

Height	Group SS	Group CS
Mean	164.93	162.74
SD	5.63	5.53
p value	0.144 Not significant	

CHART 4 : COMPARISON OF HEIGHT

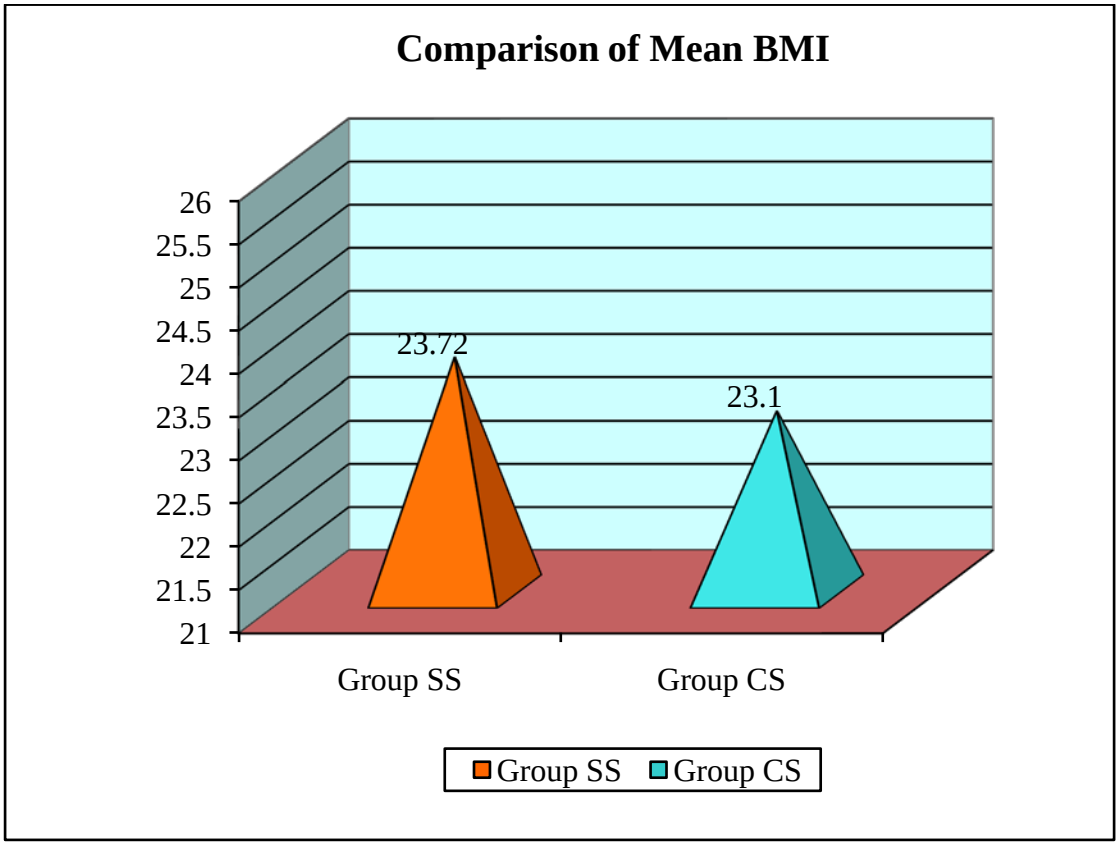


The mean height in SS group is 164.93 and in CS group is 162.74 and p value >0.005, so statistically not significant, so both groups are comparable.

TABLE 6 : COMPARISON OF MEAN BMI

BMI	Group SS	Group CS
< 25	13	20
> 25	17	10
Mean	23.72	23.1
SD	4.31	3.99
p value	0.581 Not significant	

CHART 5 : COMPARISON OF MEAN BMI

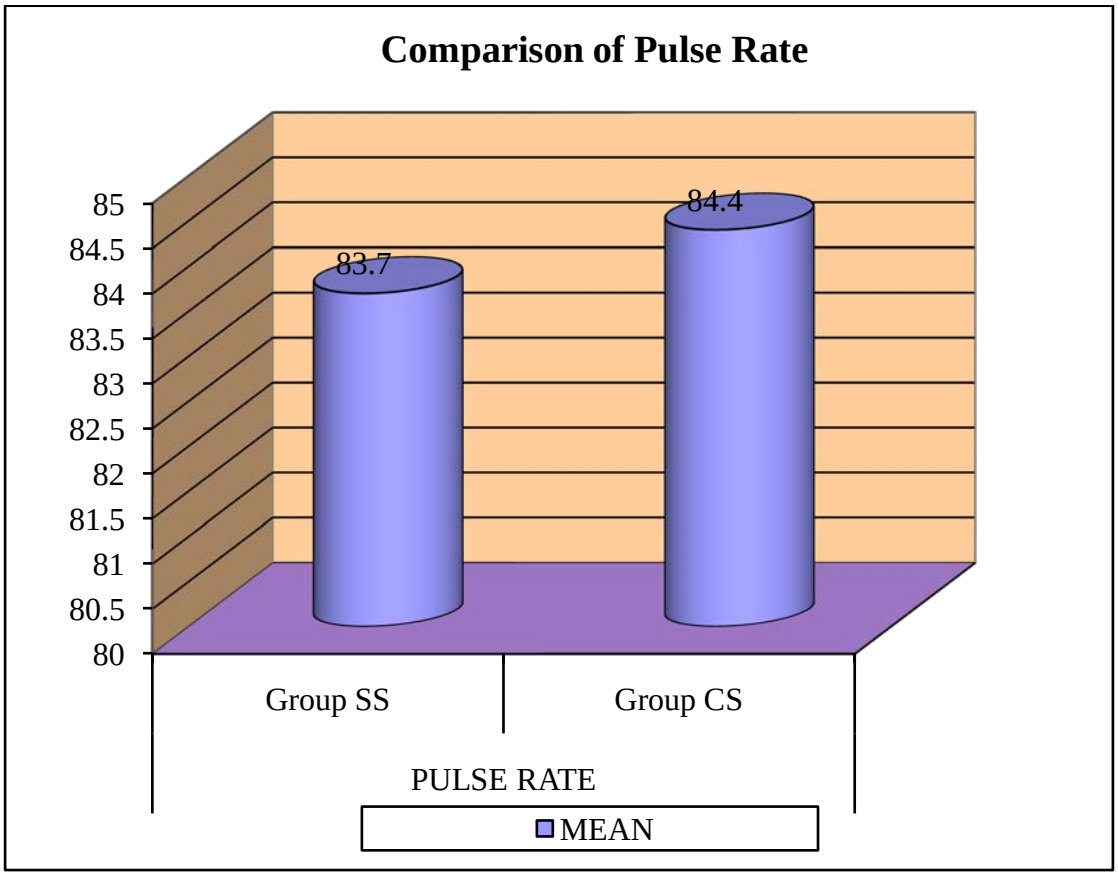


The mean BMI in SS group is 23.7 and CS group is 23.1 and p value >0.005, so statistically not significant, so both groups are comparable and also satisfy the inclusion criteria.

TABLE 7 : COMPARISON OF PULSE RATE

	PULSE RATE		SD		p value
	Group SS	Group CS	Gr SS	Gr CS	
PR	83.7	84.4	9.69	1.93	0.79

CHART 6 : COMPARISON OF PULSE RATE



The mean pulse rate between the groups is 83 and 84, and p <0.005, not significant, so both groups are comparable.

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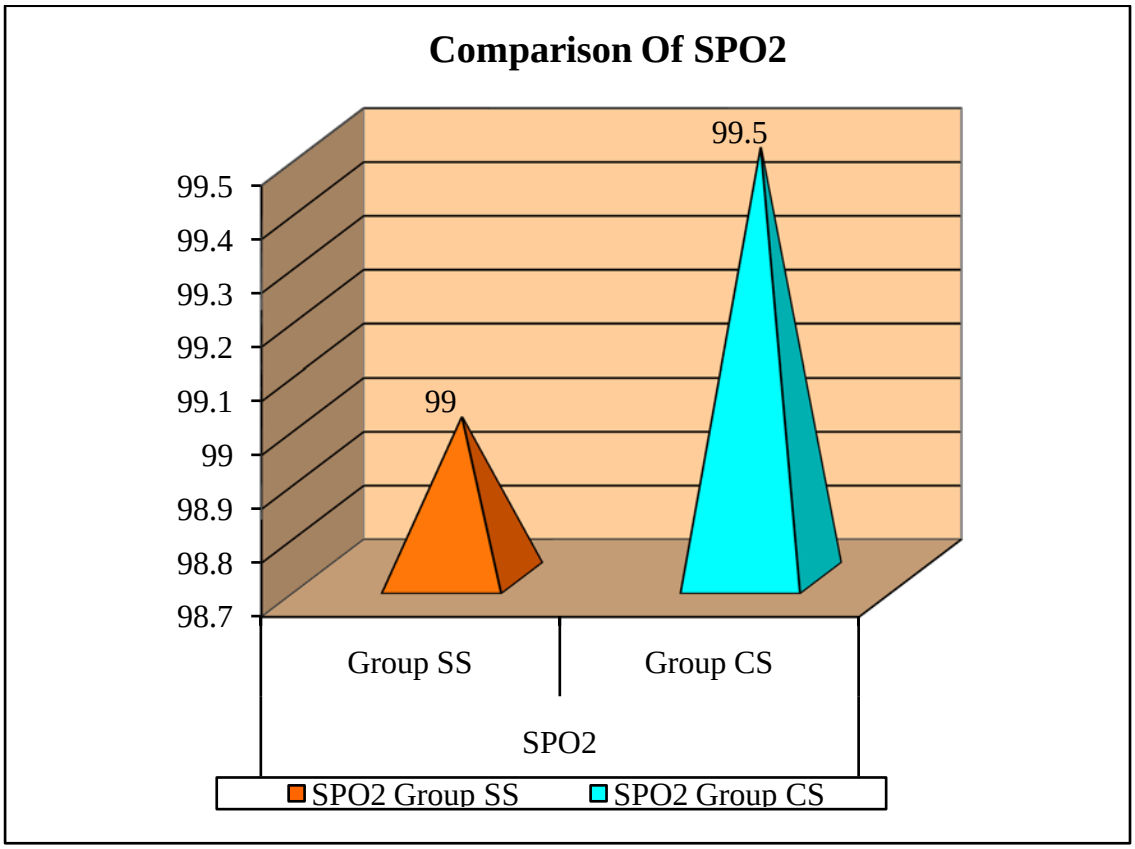
TABLE 9 : COMPARISON OF SPO2

	SPO2		SD		p value
	Group SS	**Group CS**	**Gr SS**	**Gr CS**	
SPO2	99	99.5	0.83	0.78	0.019

CHART 8 : COMPARISON OF SPO2

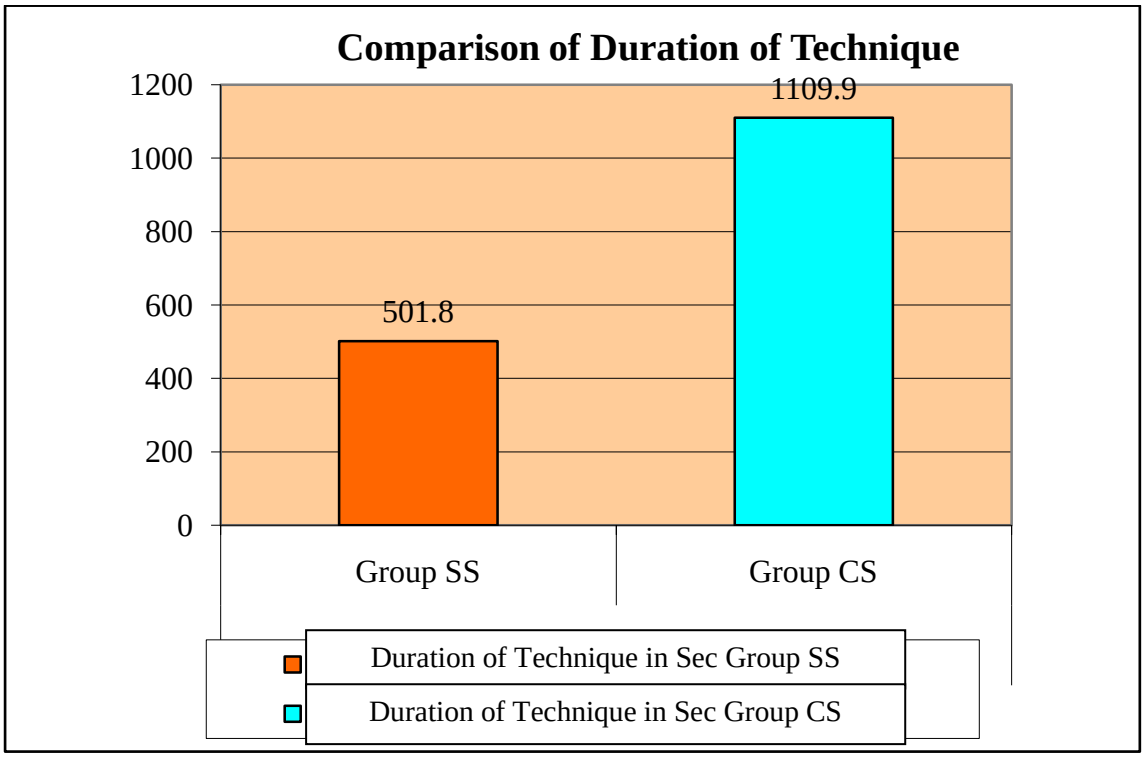


The mean SPO2 in group SS is 99 and group CS is 99.5 p value is 0.019 is taken as significant but this profile is not much significant, because SPO2 is 99 and 99.5 SPO2 is measured as whole number and SPO2 within 95-100 is normal, so both groups are comparable though statistically significance is shown.

TABLE 10 : COMPARISON OF DURATION OF TECHNIQUE

	DURATION OF TECHNIQUE IN SEC		SD		p value
Duration of Techni	**Group SS**	**Group CS**	**Gr SS**	**Gr CS**	
Duration of Techni	501.8	1109.9	89.5	173.7	< 0.001

CHART 9 : COMPARISON OF DURATION OF TECHNIQUE

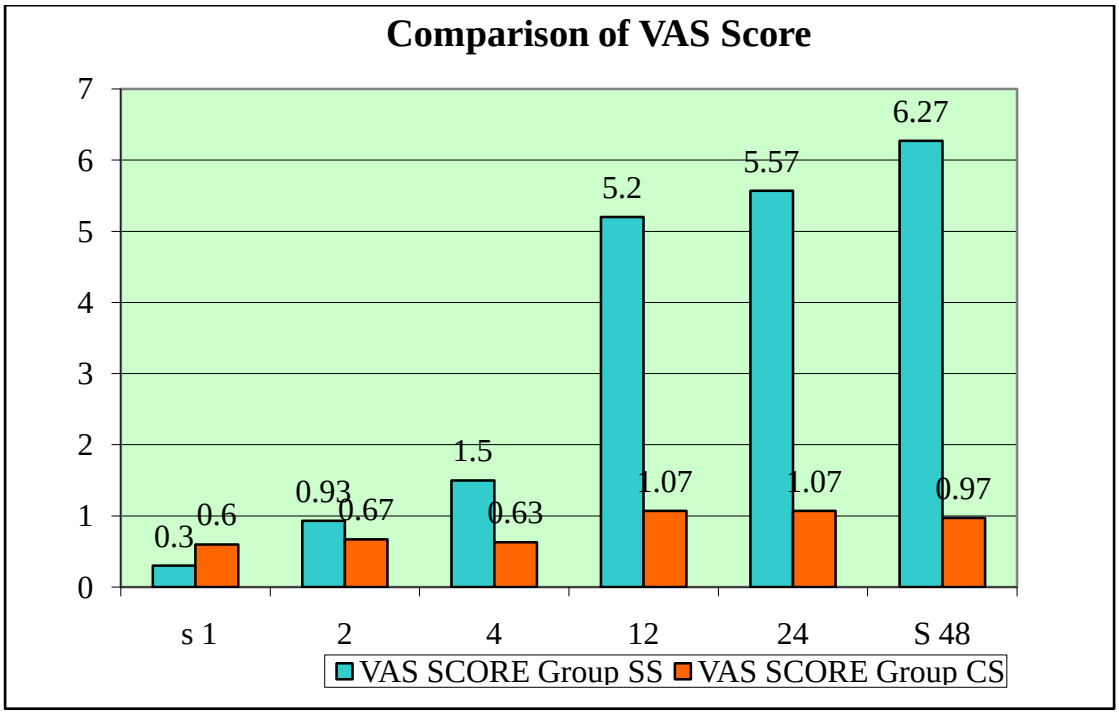


It is a well known fact that single shot takes 501 seconds in an average and continuous perineural catheter takes 1109 seconds, which is longer. This parameter is out of scope of our study, but separate studies have been done. The duration of technique is within the time taken as referred in various studies by us.

TABLE 11 : COMPARISON OF VAS SCORE

	VAS SCORE		SD		p value
	Group SS	Group CS	Gr SS	Gr CS	
s 1	0.3	0.6	0.47	0.49	0.019
2	0.93	0.67	0.37	0.48	0.019
4	1.5	0.63	1.17	0.62	< 0.001
12	5.2	1.07	1.24	0.74	< 0.001
24	5.57	1.07	1.28	0.74	< 0.001
S 48	6.27	0.97	1.08	0.41	< 0.001

CHART 10 : COMPARISON OF VAS SCORE

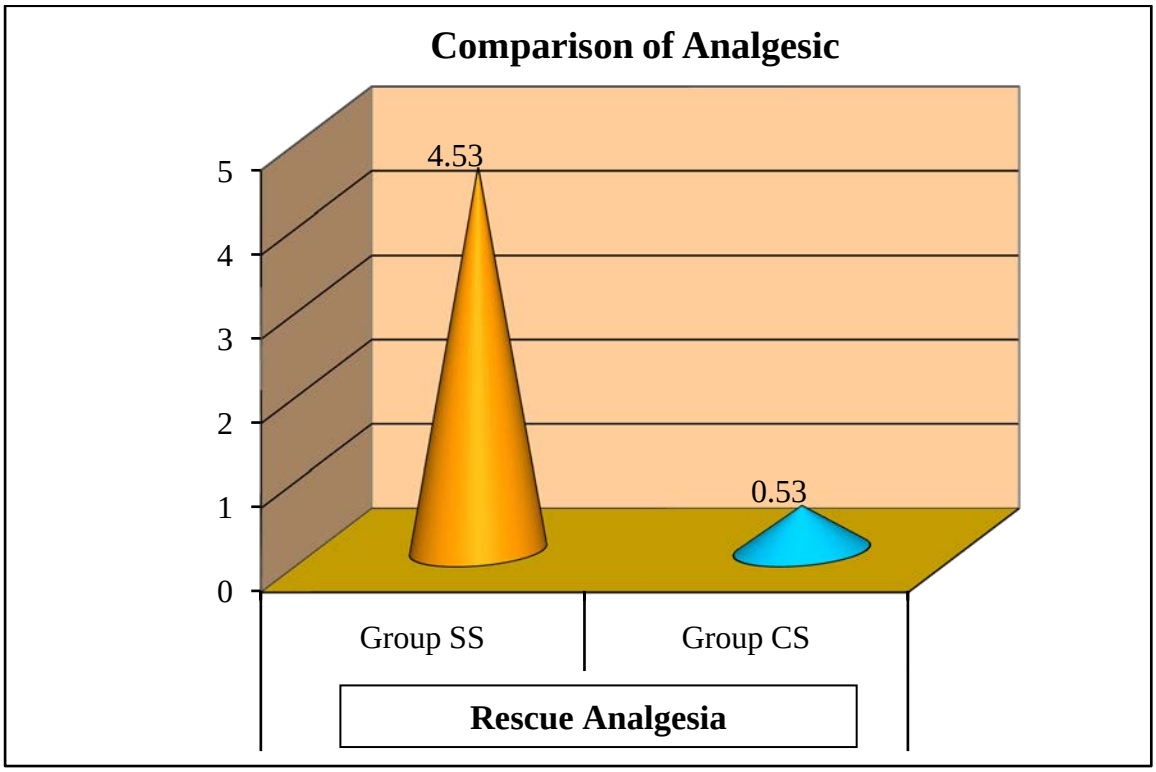


VAS Score is taken for 1st hour, 2nd hour, 6th hour, 12th hour, 24th hour, 48th hour and found to be significant. The main aim of our study is to compare post operative pain relief, as VAS score shows statistically significance, it has thus elucidate the various literatures as reviewed as thus.

TABLE 12 : COMPARISON OF RESCUE ANALGESIA

	ANALGESIC		SD		p value
	Group SS	**Group CS**	**Gr SS**	**Gr CS**	
Analgesic	4.53	0.53	1.25	0.73	< 0.001

CHART 11 : COMPARISON OF RESCUE ANALGESIA



Break through pain and rescue analgesic score is found to be 4.53 in Group SS and 0.53 in Group CS and it is also significant.

Thus statistical analysis proves that the postoperative pain relief, Break through pain and rescue analgesia score are less than 0.005 and they are statistically significant and thus this study has proved and elucidated as published in literatures reviewed by us.

DISCUSSION

"Single Shot peripheral nerve block had few problems like short duration of analgesia, frequent Break through pain, additional requirement of opioids, and high incidence of opioid related side effects but C-PNB has overcomed these problems. This study was carried out in 60 adult patients, to findout the efficacy of continuous perineural catheters."

"J.E. Chelly, D. Chisti and A. Fenneii[13] in their study, they concluded that continuous nerve blocks have proved safe and effective in reducing opioid consumption and related side effects, accelerating recovery reducing the length of stay in Hospital. This study also concluded that there is reduced postoperative analgesic requirement early recovery and reduced related opioid side effects.

"Klein et al [12] did a prospective study, and found that patient receiving continuous infusion of perineural 0.25% of Bupivacaine at 5 ml / hr averaged 1 on a visual analogue pain. This study is also proves that 0.25% Bupivacaine at 5 ml/hr also averaged 1 on VAS Score."

"IIfeld BM, Enneking FK et al[19] did a study which showed that C-PNB provide superior analgesia at rest for first 24 hours and with activity for 48 hours. This study concluded that C-PNB provided superior analgesia at rest for the first 18 hours and with activity for next 48 hours."

"Ingo Bergmaann et al[15] did a study, where peripheral nerve block gives greater haemodynamic stability than general anaesthesia; this study also concluded that the haemodynamics parameters was stable during perioperative period."

SUMMARY

In adult patient undergoing upper limb orthopedic surgery under various block techniques as described in materials and method found that the post operative pain relief is better in C-PNB, incidence of Break through pain, and requirement of rescue analgesia is related side effects.

CONCLUSION

This study concluded that continuous peripheral nerve blocks provide better post operative pain relief, less incidence of break through pain reduction in requirement of rescue analgesia. The secondary objective of our study is also satisfied by better sleep quality, patient's satisfaction, early post operative mobilization and early attendance to work.

Thus this study has proved the benefits of continuous perineural catheters over single shot nerve blocks as published in review literatures.

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9. Aguirre et al., (2012) stated that the most common use of C-PNB is in the peri and post operative period but different indications have been described like treatment of chronic pain such as cancer induced pain, complex regional pain syndrome or phantom limb. The documented benefit strongly depends on the analgesia quality and includes decreasing baseline / dynamic, reading analgesic requirement decrease of post operative joint inflammation and inflammatory markers.
10. Tamosuina R', Gudas R, Karbonskiene A, Marchetiene I studied efficacy of continuous interscalene brachial plexus block with bupivacaine 0.17% for post operative analgesia after shoulder surgery and concluded that bupivacaine showed less pain at rest and in motion than the placebo group except 4 h and 6 h after brachial plexus block, requirement of supplemental analgesia was also lower. Side effects, circulatory and respiratory parameters were comparable in both groups. Satisfaction scores were higher in bupivacaine group.

11. Rawal et al., 1994 described outpatient perineural infusion using a percutaneous catheter and a small light weight. He described ambulatory perineural infusions in various anatomic locations including paravertebral, interscalene, intersternocleidomastoid, infraclauicular, axillary, psoas compartment.
12. Klein et al provided the first prospective evidence quantifying infusion benefits in 2000. This randomized double – masked placebo – controlled investigation involving subjects undergoing open rotator cuff repair who received an interscalene block and perineural catheter preoperatively and they were randomized to receive either perineural Bupivacaine 0.25% or normal saline postoperatively 10m/hr. Patient receiving perineural placebo averaged 3 on a visual analog pain scale of 0 to 10, compared with 1 for subjects receiving 0.25% Bupivacaine.
13. J.E. Chelly, D. Chisti and A. Fanneii conducted a study in (University of Pittsburgh Medical Centre) says that continuous nerve blocks have proved safe and effective in reducing opiod consumption and related side effects, accelerating recovery and in many patients reducing the length of stay in Hospital. Continuous nerve blocks provides a safer alternatives to epidural analgesia in patients receiving thromboprophylaxsis especially with low molecular weight heparin, they also concluded that continuous nerve blocks represents an important therapeutic tool in managing perioperative pain and trauma pain. They have been proved safe and effective, especially when combined with multimodal approach to pain management.

14. Ingo Bergmann, Maximillian Heetfeld, Thomas A Crozier, did a study which was published in central European Journal of Medicine to know whether peripheral nerve block gives greater hemodynamic stability than general anesthesia in ASA III patients underhoing knee orrthroscopy, outpatient with preexisting. Cardiovascular and pulmonary disorders and they concluded that peripheral neve block provides a more stable hemodynamic course than general anesthesia in ASA III patients.
15. Brain et al., in University of California, Sanniego did a research study to determine if the effects of continuous peripheral nerve blocks are influences by the distance of insertion post the needle tip of the perineural catheters concluded that the hip of the needle past 3 – 5 cms had better pain score than 0 – 1 cms.
16. Charles Pham-Dang published an article in Regional Anesthesia and pain medicine, they evaluated the efficacy of stimulating catheters that were used for continuous peripheral nerve blocks as a means of immediate verification and confirmation of correct catheter position. The amperage used to elicit motor responses typically was higher with the catheter than with the introducer needle and thus concluded that the ability to electro stimulate nerves using an insitu catheter increases success in catheter placements for continuous peripheral nerve blocks.
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PROFORMA

TO ELUCIDATE THE BENEFIT OF CONTINUOUS PERINEURAL CATHETERS OVER SINGLE SHOT PERIPHERAL NERVE BLOCKS ACCORDING TO PUBLISHED LITERATURE

Case No : I.P.no:-

NAME :

ADDRESS :

AGE :

SEX :

D.O.ADMISSION :

HISTORY IN BRIEF :

CLINICAL DIAGNOSIS/ INDICATION :

EXAMINATION IN BRIEF :

❖ Vitals

- PULSE
- B.P-
- AIRWAY-ASSESSMENT

❖ **SYSTEMIC EXAMINATION**

❖ **BASELINE HAEMODYNAMICS :**

- PR:
- BP:
- SPO2:

INVESTIGATIONS

* COMPLETE BLOOD COUNT
* RANDOM BLOOD SUGAR
* BLOOD UREA SERUM CREATININE
* BT CT

URINE EXAMINATION- ALBUMIN SUGAR MICROSCOPY

CHEST X-RAY :

ECG :

ASA GRADING :

SURGICAL PROCEDURE :

DURATION :

PARAMETERS OBSERVED-

VAS SCORE

Break through Pain

Rescue Analgesia

Duration of Technique in Seconds

Adverse Effects

* Nausea +/-
* Vomiting +/-

Intra operative monitoring

Time After Block	PR	MAP	SPO2
5min			
10min			
20 min			
30 min			
45 min			
60 min			
EOS			

Post operative monitoring

Time After Surgery	PR	MAP	SPO2
1H			
2H			
8H			
12H			
24H			
48H			

ஆராய்ச்சி ஒப்புதல் படிவம்

கையில் ஏற்படும் எலும்பு முறிவு அறுவை சிகிச்சைக்காக தோள்பட்டையில் உள்ள நரம்பு கூடுகளில் செலுத்தப்படும் மயக்கமருந்து மற்றும் தொடர் மயக்க மருந்து கொடுக்கும் சூழல் ஏற்படும் விளைவுகள் பற்றிய ஆய்வு.

பெயர் :

வயது :

இனம் :

உள்நோயாளி எண் :

அறுவை சிகிச்சை :

விளக்கம் :

கைகளில் ஏற்படும் எலும்பு முறிவுக்கு செய்யப்படும் அறுவை சிகிச்சைக்காக செலுத்தப்படும் உணர்விழக்கச் செய்யும் முறையில் புபிவேகெய்ன் எனும் மயக்க மருந்து, தோள்பட்டையில் உள்ள நரம்பு கூடுகளில் தொடர் ஊசி குழல் மூலம் செலுத்தி அறுவை சிகிச்சை செய்வதனால் ஏற்படும் பயன்கள், விளைவுகள், பக்க விளைவுகள் பற்றி எனக்கு நன்கு புரிகின்ற தமிழ் மொழியில் தெளிவாக விளக்கி கூறப்பட்டது.

என்னுடைய அடையாளம் எந்த வகையிலும் இந்த ஆராய்ச்சி மூலம் வெளியே தெரியாது என்பதை அறிவேன். இந்த ஆராய்ச்சியில் இருந்து எந்த நேரமும் விலகலாம் என்பதையும் அதனால் பாதிப்பும் ஏற்படாது என்பதையும் அறிவேன்.

நான் யாருடைய நிர்பந்தமுமின்றி என் சொந்த விருப்பத்தின் பேரில் சுயநினைவுடன் இந்த ஆராய்ச்சியில் பங்கு கொள்ள சம்மதிக்கிறேன்.

இடம் : கையொப்பம்

நாள் :

Sl.No.	Name of the Patient	Age	Sex	Wt (Kgs)	Ht (cms)	BMI	ASA	Group	Diagnosis	Baseline			Duration of Technique in Seconds	Intra OP PR						
										PR	MAP	SPO2		5m	10m	20 m	30 m	45 m	60 m	EOS m
1	Sivasubramanian	45	M	45	160	17.6	I	SS	# R corawid with Gelnoia	83	97	99	408	88	84	76	69	87	88	88
2	Chockkalingam	65	M	60	169	21	II	SS	Segment # R humerus	84	95	99	400	85	80	76	72	69	70	72
3	Essakiammal	45	F	74	164	27.9	II	SS	# R humerus D/3	85	97	98	505	97	98	97	81	78	76	73
4	Sangeetha	29	F	78	172	26.4	II	SS	Supracondylor # L Humerus	98	88	99	600	87	85	79	77	75	75	78
5	Irudhayaraj	37	M	69	166	25	I	SS	# distal radius	65	94	100	603	99	100	91	87	84	93	95
6	Ramalakshmi	60	F	43	150	19.1	II	SS	# R Eeavicle	66	90	100	508	92	96	98	100	89	88	78
7	Kombiah	45	M	45	160	17.6	II	SS	# Surgical Neck of humerus	98	86	100	409	63	58	60	72	72	80	64
8	Saraswathy	55	F	75	164	27.9	II	SS	# L ULNT	102	87	99	635	84	96	96	98	99	76	78
9	Murugaraj	26	M	80	173	26.7	I	SS	AC Joints Disurption	78	97	99	438	92	99	98	84	80	82	82
10	Rangaswamy	55	M	75	164	27.9	II	SS	Old united # R. Clavicle	79	92	98	380	89	90	100	91	81	84	81
11	Muthu Hari	13	F	42	154	17.7	I	SS	Old A R Lateral enderclavicle	82	95	99	388	86	87	99	88	84	80	77
12	Bala Krishnan	44	M	80	172	27	II	SS	# ULNA B P 1/3	86	86	99	496	78	92	98	81	78	74	69
13	Ramaiah	27	M	80	173	26.7	II	SS	# BB A Forearm	103	84	100	630	84	86	100	82	80	74	72
14	Lakshmi	37	F	68	164	25.3	II	SS	Supracondylor # R Humerus	68	86	100	580	84	99	90	84	79	78	78
15	Velu	55	M	75	164	27.9	II	SS	2 Part # numerus	74	88	100	583	86	89	100	82	80	74	78
16	Arunachalam	35	M	81	170	28	I	SS	Clavicle # M/3 L Side	73	84	98	610	82	89	98	82	86	78	79
17	Manohar	54	M	52	165	19.1	II	SS	# R scaphoid	86	89	98	435	86	88	90	93	96	87	82

Sl.No.	Intra OP MAP							Intra OP SPO2							POST - OP - PR							POST - OP - MAP				
	5m	10m	20 m	30 m	45 m	60 m	EOS m	5m	10m	20 m	30 m	45 m	60 m	EOS m	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	8 H	12 H
1	93	86	84	77	79	79	80	97	98	98	99	99	99	99	68	78	80	77	88	77	77	92	88	84	76	78
2	96	88	73	64	63	63	80	100	98	100	98	100	100	100	74	79	88	84	85	88	85	88	96	78	78	80
3	98	101	97	90	90	84	82	99	97	98	96	95	100	100	81	84	85	99	91	99	99	84	98	101	97	98
4	98	99	98	90	84	82	71	98	97	98	98	99	99	99	75	77	81	78	75	75	78	99	99	98	100	100
5	89	89	101	87	76	69	70	96	96	95	99	98	97	99	78	83	75	73	85	85	85	65	94	96	98	100
6	93	92	103	91	72	81	80	99	99	97	98	99	100	100	80	78	92	86	86	87	88	90	88	94	94	88
7	97	96	98	98	97	98	99	100	100	100	100	100	100	100	69	78	81	86	91	86	86	86	88	88	86	88
8	73	91	84	88	76	78	78	98	99	100	100	98	99	100	79	76	96	88	81	88	88	87	88	86	80	90
9	71	93	103	91	72	81	81	97	99	99	99	87	99		72	77	78	79	72	78	78	92	85	80	72	79
10	74	87	82	84	86	76	72	97	98	99	99	98	98		78	79	82	86	78	78	78	95	87	72	65	64
11	97	88	84	76	74	85	82	99	99	98	97	99	99		79	79	82	82	86	89	80	99	102	98	91	91
12	97	96	97	87	82	77	79	98	99	99	99	100	100		69	68	69	72	74	77	80	98	99	100	100	100
13	91	84	88	84	76	76	76	97	98	99	99	100	100		74	76	78	79	80	86	88	89	88	96	96	70
14	91	84	88	76	78	88	76	97	99	97	98	99	100		68	80	72	74	74	78	78	102	90	90	86	86
15	96	98	81	73	64	63	78	98	98	99	99	98	100		75	74	72	72	70	68	68	97	96	98	98	99
16	96	98	88	81	73	64	68	98	98	98	99	99	100		83	82	81	80	80	72	72	91	86	88	78	80
17	96	88	89	89	90	95	94	97	97	97	97	97	97		81	80	80	81	82	84	86	98	100	96	90	90

Sl.No.			POST - OP - SPO2							VAS Score						No. of Breakthrough Analgeis	No. of rescue analgesia F = FENTANYL D-DICLOSENALC SODIUM	ORSE
	24 H	48 H	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	12 H	24 H	48 H			
1	78	86	97	98	99	96	98	99	100	1	2	2	6	5	5	3	Fentanyl 2 Doses	Nausea + Vomitting +
2	82	84	99	98	97	99	99	98	99	0	1	2	4	5	6	4	Fentanyl 3 Doses Diclofenc - 1 Dose	Nausea + Vomitting +
3	90	84	98	97	96	95	96	95	96	0	0	1	4	4	4	4	Fentanyl - 4 Doses Diclofenc - 3 doses	Nausea + Vomitting +
4	98	99	96	96	98	99	96	99	99	1	1	1	5	6	7	5	Fentanyl - 3 Doses Diclofenac- 2 Doses	Nausea + Vomitting +
5	92	90	98	99	99	98	97	98	99	0	1	4	4	6	7	4	Fentanyl - 2 Doses Diclofenac- 1 doses	Nausea + Vomitting +
6	86	90	100	100	99	99	100	100	100	0	1	5	5	6	7	6	Fentanyl - 3 Doses Diclofenac - 2 Doses	Nausea +
7	88	86	100	100	100	100	99	100	100	1	1	5	4	4	8	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Vomitting +
8	92	94	99	98	100	99	100	100	100	0	0	3	2	4	4	4	Fentanyl - 2 Doses Diclofenac - 2 Doses	-
9	80	80	97	98	99	100	100	100	100	0	1	1	5	5	6	3	Fentanyl - 1 Dose Diclofenac - 2 Doses	Nausea + Vomitting +
10	64	81	99	100	99	100	99	99	98	0	1	1	6	7	5	4	Fentanyl - 1 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
11	85	85	100	100	99	99	100	100	100	1	1	1	6	7	7	5	Fentanyl - 2 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
12	84	99	96	97	98	99	100	100	100	0	1	1	5	5	7	4	Fentanyl - 2 Doses Diclofenac - 2 Doses	Nausea + Vomitting +
13	89	89	96	96	96	99	99	100	100	0	1	1	5	5	6	5	Fentanyl - 2 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
14	86	90	100	98	99	99	100	99	98	1	1	1	5	5	7	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
15	99	100	97	96	99	99	98	99	100	0	1	1	4	4	6	2	Fentanyl - 1 Dose Diclofenac - 1 Doses	Nausea + Vomitting +
16	82	84	100	100	100	98	98	99	100	0	1	1	7	7	7	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
17	86	86	98	98	98	98	98	98	98	0	1	1	5	5	8	4	Fentanyl - 1 Dose Diclofenac - 3 Doses	Nausea + Vomitting +

Sl.No.	Name of the Patient	Age	Sex	Wt (Kgs)	Ht (cms)	BMI	ASA	Group	Diagnosis	Baseline			Duration of Technique in Seconds	Intra OP PR						
										PR	MAP	SPO2		5m	10m	20 m	30 m	45 m	60 m	EOS m
18	Jeyapratha	13	F	40	156	16.4	I	SS	Supracondylar R numerus	87	93	99	539	89	96	99	84	70	77	78
19	Murugan	60	M	52	165	19.1	II	SS	# Radius Rt Forearm	88	96	99	600	94	80	88	86	90	92	94
20	Valliammal	60	F	52	165	19.1	I	SS	# R ULNA	82	90	99	630	78	79	86	86	89	90	86
21	Sudalaikannu	45	M	80	170	27.7	I	SS	Loosed bodies Left Knee	78	95	100	580	68	78	89	99	83	68	78
22	Selvaraj	43	M	75	164	27.9	I	SS	# R Pronimal Hungavs	90	102	97	495	70	72	68	70	70	89	78
23	Guruswamy	48	M	68	164	25.3	II	SS	#R Clavicle	89	98	98	500	102	99	98	92	96	95	94
24	Murugan	60	M	52	165	19.1	II	SS	# ULNA L Side	75	83	99	408	98	99	99	97	86	102	102
25	Murugaraj	70	M	60	169	21	II	SS	# Supra Condycl R humerus	83	90	98	308	72	72	76	78	86	84	82
26	Muthumurugayee	40	F	70	160	27.3	II	SS	# 9AlA ZZEI L Side	91	89	99	405	84	84	86	88	86	88	88
27	Arunachalam	25	M	48	164	17.8	I	SS	# L ULNA	90	96	100	500	98	88	88	86	85	84	78
28	Sivapandian	40	M	70	160	27.3	II	SS	Supracondycnl # R Femur	86	99	98	500	78	78	76	74	72	70	78
29	Annaraj Peter	43	M	80	170	27.7	II	SS	# Clavicle R Side	74	90	99	490	79	80	82	84	86	88	89
30	Rajan	34	M	80	172	27	I	SS	# L UINA	88	87	100	490	65	66	68	72	78	78	78
31	Kumaraswamy	60	M	45	160	17.5	I	CS	Closed # BB L Forearm	82	96	100	1082	82	80	78	76	80	82	90
32	Sivanpandian	40	M	70	170	24.2	II	CS	# Olecfa non R ULNA	82	94	99	1081	82	80	76	77	89	90	96
33	rajan	30	M	56	164	20.8	II	CS	Type II Distal radius with scapnoid	78	97	99	998	78	90	92	78	76	60	78

Sl.No.	Intra OP MAP							Intra OP SPO2							POST - OP - PR							POST - OP - MAP				
	5m	10m	20 m	30 m	45 m	60 m	EOS m	5m	10m	20 m	30 m	45 m	60 m	EOS m	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	8 H	12 H
18	96	87	84	79	77	64	69	98	99	99	98	99	96		69	70	72	74	76	78	78	96	88	86	80	78
19	74	76	87	86	96	90	84	96	95	90	95	95	96		68	66	89	72	86	68	68	74	78	88	88	96
20	93	86	84	77	79	80	82	97	98	99	100	100	100	100	82	80	80	81	78	78	76	89	90	92	90	92
21	96	88	81	73	64	78	82	100	100	99	99	100	99	100	80	82	84	86	96	98	84	94	96	96	86	84
22	98	102	97	90	84	82	77	98	99	99	99	98	99	98	92	90	98	94	94	86	86	100	96	96	89	90
23	89	102	87	76	69	82	82	97	96	98	98	99	98	99	90	88	88	98	86	88	88	96	99	98	89	86
24	96	87	84	79	71	79	80	99	98	99	99	99	98	99	74	74	72	70	76	78	78	82	81	82	83	99
25	97	88	84	76	72	78	88	97	98	98	99	99	99	99	82	84	80	80	82	86	88	99	98	96	94	93
26	97	96	87	82	77	76	76	99	98	97	99	99	99	99	90	92	92	94	96	96	96	89	88	86	87	88
27	97	93	87	88	90	94	76	100	100	100	98	99	99	98	90	92	94	94	94	89	88	99	100	102	104	99
28	98	101	97	90	84	84	90	98	99	99	98	97	96	100	88	86	80	82	84	84	84	96	95	94	96	96
29	96	97	84	89	76	69	82	100	99	99	99	99	98	99	76	77	79	80	82	84	84	90	90	90	90	92
30	97	93	87	88	76	76	76	97	97	97	98	99	99	97	89	90	91	92	94	96	98	88	87	86	80	80
31	97	90	97	86	94	92	90	99	98	97	100	100	97	99	78	79	80	82	84	86	86	90	92	86	88	88
32	95	93	92	94	90	91	92	100	98	100	99	100	98	100	78	80	78	70	72	68	56	88	90	92	88	86
33	98	99	86	94	92	90	90	100	99	100	97	97	97	96	82	80	80	96	96	82	83	94	78	78	96	96

Sl.No.			POST - OP - SPO2							VAS Score						No. of Breakthrough Analgeis	No. of rescue analgesia F = FENTANYL D-DICLOSENALC SODIUM	ORSE
	24 H	48 H	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	12 H	24 H	48 H			
18	80	88	99	100	100	96	96	96	98	0	1	1	7	8	7	5	Fentanyl - 2 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
19	92	84	100	100	98	98	98	98	99	0	1	1	5	4	5	4	Fentanyl - 2 Doses Diclofenac - 2 Doses	Nausea + Vomitting +
20	90	92	99	98	97	96	99	99	99	0	1	1	4	4	6	2	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
21	82	82	100	100	100	96	99	96	97	1	1	1	5	5	7	3	Fentanyl - 1 Doses Diclofenac - 2 Doses	-
22	92	78	97	100	98	99	98	97	98	0	1	1	7	8	7	3	Fentanyl - 2 Doses Diclofenac - 2 Doses	-
23	84	99	98	100	100	100	98	99	99	0	1	1	5	5	6	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea +
24	96	96	99	100	98	99	98	99	98	0	0	1	4	4	5	5	Fentanyl - 3 Doses Diclofenac - 2 Doses	Nausea + Vomitting +
25	92	90	98	100	98	99	99	99	99	1	1	1	5	6	7	4	Fentanyl - 2 Doses Diclofenac - 2 Doses	-
26	88	88	99	99	99	98	99	98	99	0	1	1	6	7	5	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
27	99	99	100	97	96	100	100	100	100	1	1	1	7	7	7	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
28	96	96	98	100	100	99	100	99	100	0	1	1	8	7	7	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
29	96	96	99	98	99	99	98	99	100	0	1	1	5	5	7	6	Fentanyl - 3 Doses Diclofenac - 3 Doses	Nausea + Vomitting +
30	80	90	100	100	100	98	99	100	100	1	1	1	6	7	5	5	Fentanyl - 3 Doses Diclofenac - 2 Doses	-
31	90	90	98	99	99	97	98	99	100	1	0	1	2	1	1	1	Fentanyl - 1 Dose Diclofenac - 1 Dose	Nausea + Vomitting +
32	90	90	100	97	97	99	96	95	100	0	0	2	2	1	1	0	Diclofenac - 1 Dose	-
33	91	95	96	96	99	99	99	100	100	1	0	1	1	3	2	1	Diclofenac - 1 Doses	-

Sl.No.	Name of the Patient	Age	Sex	Wt (Kgs)	Ht (cms)	BMI	ASA	Group	Diagnosis	Baseline			Duration of Technique in Seconds	Intra OP PR						
										PR	MAP	SPO2		5m	10m	20 m	30 m	45 m	60 m	EOS m
34	Sivathiammal	45	F	65	160	25.4	II	CS	OLP Monteggia # Dislocations L Side	98	86	100	1290	98	100	102	98	97	99	100
35	Budhyaraj	37	M	68	158	27.2	I	CS	Chronic Osteomyelitis @ Humerus	70	94	100	1300	70	72	68	74	76	77	78
36	Shanmugakutti	45	M	60	158	24	II	CS	Closed # Intercondynl Humerus	76	94	100	890	76	90	94	88	86	85	83
37	Rajasekar	15	M	30	155	12.5	I	CS	Closed # L ULNA	82	96	100	990	82	81	80	78	76	77	80
38	Mohamed Ali	65	M	50	160	19.5	II	CS	Malunited Distal radius	100	96	100	1350	100	99	78	78	80	80	86
39	Mathi Parthiban	16	M	45	150	20	II	CS	3 part # proximal R humerus	98	86	100	998	98	102	104	99	86	90	92
40	Senthil Nayagam	58	M	68	164	25.3	II	CS	# shaft of UINA	100	97	99	1020	100	101	99	98	89	99	91
41	Ganapathy	60	M	75	170	25.8	II	CS	# Shaft of Humerus	98	98	99	998	98	88	76	96	95	94	92
42	Jayalakshmi	18	F	50	155	20.8	II	CS	Postcubitus Varaus Correction	87	78	100	1020	87	86	85	84	82	80	80
43	Mayil Swamy	60	M	60	158	24	I	CS	Old Neglected & dislocation of Elbow	86	97	97	900	85	84	80	84	89	90	78
44	Muthurkrishnan N	45	M	50	160	19.5	I	CS	# Dislocation R Shoulder	97	86	98	1002	96	90	78	80	88	86	88
45	Cherman	55	M	52	165	19.1	I	CS	Communited # M/2 R Clavicle	80	88	99	990	79	80	82	80	82	80	86
46	Ayyadurai	50	M	80	170	27.7	II	CS	# 4th Meta Carpal	68	84	100	880	69	72	74	78	82	86	84
47	Ramkumar	50	M	80	172	27	II	CS	# L ULNA	62	78	100	1400	60	62	68	72	76	86	80
48	Maria Selvam	55	F	75	164	27.9	II	CS	Implant riaws with BB R forearm	75	90	99	1380	74	72	86	88	90	84	80
49	Krishnan	29	M	78	172	26.4	II	CS	# Right Clavicle	89	82	100	1400	89	80	88	84	2	88	86

Sl.No.	Intra OP MAP							Intra OP SPO2							POST - OP - PR							POST - OP - MAP				
	5m	10m	20 m	30 m	45 m	60 m	EOS m	5m	10m	20 m	30 m	45 m	60 m	EOS m	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	8 H	12 H
34	87	80	84	82	80	81	82	99	100	100	97	99	100	100	87	88	90	92	94	96	98	92	91	99	86	84
35	95	94	90	92	93	90	94	100	87	97	98	99	100	100	98	100	100	96	88	84	84	90	80	81	86	96
36	95	94	90	92	92	92	91	100	97	98	99	100	100	100	100	98	96	94	92	90	92	68	96	94	93	92
37	96	98	98	99	96	94	92	100	97	100	100	99	100	99	86	88	88	89	88	89	90	75	86	86	84	83
38	99	98	94	96	99	99	96	99	98	99	10	98	99	100	88	90	86	84	82	82	82	80	78	76	96	88
39	89	88	89	90	92	94	96	99	100	100	96	95	96	96	89	90	91	94	94	92	82	84	84	83	92	84
40	98	99	96	96	89	89	99	99	100	96	89	90	94	99	90	92	92	94	94	94	90	86	78	78	68	86
41	99	98	97	100	89	86	98	100	99	96	95	95	95	96	78	80	82	82	84	84	86	88	80	81	86	96
42	9	97	96	94	94	94	98	99	89	89	90	91	92	99	77	80	82	84	86	88	90	89	90	90	88	78
43	97	96	94	92	97	86	86	99	99	100	98	97	100	97	92	94	99	100	86	88	82	86	80	82	80	78
44	80	78	80	82	84	86	88	98	100	99	98	97	100	100	74	78	82	82	82	72	79	88	80	82	84	78
45	82	80	82	84	86	90	80	99	98	97	97	98	99	100	80	94	76	86	82	78	78	80	80	80	86	84
46	84	86	82	80	78	80	82	100	97	98	99	100	98	97	76	70	72	74	74	78	72	82	78	76	82	80
47	80	78	78	82	84	84	84	100	98	98	98	98	97	99	80	82	81	72	90	92	94	84	81	82	96	88
48	88	86	80	88	86	82	82	100	100	97	98	100	97	97	72	70	78	82	73	84	84	82	80	82	82	78
49	80	78	80	72	88	80	80	99	98	100	98	100	97	99	91	82	82	80	78	78	80	80	76	74	82	84

Sl.No.			POST - OP - SPO2							VAS Score						No. of Breakthrough Analgeis	No. of rescue analgesia F = FENTANYL D-DICLOSENALC SODIUM	ORSE
	24 H	48 H	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	12 H	24 H	48 H			
34	83	82	99	100	100	100	99	100	97	0	1	1	1	1	0	1	Diclofenac - 1 Doses	-
35	96	98	98	99	100	100	98	99	100	0	0	2	1	1	1	0	-	-
36	91	90	97	96	95	94	96	96	96	1	1	1	1	0	1	0	Diclofenac - 1 Dose	-
37	82	81	100	100	98	98	98	98	98	0	1	1	1	1	1	1	Diclofenac - 1 Dose	-
38	82	84	99	100	98	98	98	98	98	0	1	1	2	1	1	1	Diclofenac - 1 Dose	-
39	83	81	100	100	100	100	98	100	99	0	0	1	3	1	1	0	-	-
40	85	74	99	97	100	97	100	97	98	1	1	1	1	2	1	2	Fentanyl - 1 Doses Diclofenac - 1 Doses	Nausea + Vomitting +
41	86	86	99	99	97	98	99	97	98	0	1	1	1	1	1	1	Diclofenac - 1 Doses	-
42	78	78	98	99	99	99	99	98	100	0	1	1	1	1	1	1	-	-
43	76	76	98	100	99	100	100	98	100	1	0		1	3	2	2	Fentanyl - 1 Doses Diclofenac - 1 Doses	Nausea + Vomitting +
44	74	72	98	100	100	97	100	100	100	1	0		1	2	1	2	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
45	82	80	100	98	97	100	100	97	100	1	0		1	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
46	80	80	100		98	96	100	100	100	1	1		1	0	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
47	86	84	97	100	100	98	98	100	100	0	1		1	1	0	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
48	76	74	99	100	97	100	98	100	100	1	1		3	2	1	2	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
49	86	88	99	100	100	97	100	99	100	1	1		1	0	1	*-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-

Sl.No.	Name of the Patient	Age	Sex	Wt (Kgs)	Ht (cms)	BMI	ASA	Group	Diagnosis	Baseline			Duration of Technique in Seconds	Intra OP PR						
										PR	MAP	SPO2		5m	10m	20 m	30 m	45 m	60 m	EOS m
50	Submranian	62	M	45	160	17.6	II	CS	I Rhumerus # RUINA	88	84	100	990	86	84	90	78	94	96	78
51	Sudalaiyandi	39	M	69	166	25	I	CS	# R Clavicle	62	78	98	880	60	82	86	84	93	98	102
52	Saravanan	25	M	74	164	27.9	II	CS	Old # Olecranon Rt ULNA	94	88	100	1100	92	82	84	86	92	99	100
53	Kajah Mydeen	29	M	78	160	25	I	CS	# Left Patella	94	88	100	1200	94	92	86	80	86	80	94
54	Ramesh I	29	M	78	160	25	I	CS	Compound # BB M/3 L LFS	78	82	100	998	72	70	76	78	70	80	86
55	Venkiah	70	M	60	169	21	I	CS	# BS Rt Leg Distal	88	86	100	1100	88	90	92	94	86	82	80
56	Rajeswaran	48	M	52	165	19.1	II	CS	# R Scaphoid	92	78	99	1300	92	90	86	88	84	82	86
57	Parvathy	60	F	60	169	21	II	CS	Osteomyalitai R ULNA	90	92	100	1450	90	92	94	96	92	92	90
58	Susila Mary	35	F	69	166	25	II	CS	Old # Ulna D/3 implant insita	86	80	100	1220	86	88	86	87	88	88	90
59	Erulan	35	M	70	160	27.3	II	CS	Malunited # Shaft of L humerus	72	78	99	990	72	70	86	88	84	82	84
60	Madathi	31	F	48	164	17.8	II	CS	Old unreduced Elbow dislocation	80	84	100	1100	80	78	80	82	82	82	80

Sl.No.	Intra OP MAP							Intra OP SPO2							POST - OP - PR							POST - OP - MAP				
	5m	10m	20 m	30 m	45 m	60 m	EOS m	5m	10m	20 m	30 m	45 m	60 m	EOS m	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	8 H	12 H
50	82	78	76	74	84	82	82	100	97	98	98	98	98	97	86	80	90	86	92	92	92	82	80	82	82	80
51	80	82	84	84	86	88	88	100	98	98	100	99	100	100	74	72	70	88	90	92	92	88	80	82	84	86
52	86	85	84	82	83	81	81	98	100	99	97	100	97	97	86	80	86	80	82	88	88	81	80	82	82	82
53	88	90	92	94	96	82	82	100	97	98	99	100	99	100	100	110	98	99	100	91	98	82	92	78	74	72
54	83	82	89	92	78	76	80	98	99	100	98	99	100	100	76	76	80	72	70	82	82	82	80	80	84	86
55	88	90	88	92	78	74	80	98	99	100	100	88	99	100	86	80	78	76	74	84	84	86	84	80	82	86
56	92	94	90	88	86	90	92	98	100	100	100	98	100	100	90	88	86	84	82	86	88	78	79	82	84	86
57	80	84	90	88	86	88	84	98	100	99	100	100	100	100	88	86	80	78	80	88	90	92	90	86	85	84
58	78	80	84	86	88	90	92	97	98	99	100	100	100	98	84	80	86	82	80	86	88	80	82	84	86	88
59	84	82	80	78	80	80	80	97	98	97	98	97	98	100	70	72	70	68	72	74	76	78	80	82	84	76
60	90	88	78	80	82	86		100	100	100	100	98	99	100	82	80	78	76	78	80	82	84	80	83	86	80

Sl.No.			POST - OP - SPO2							VAS Score						No. of Breakthrough Analgeis	No. of rescue analgesia F = FENTANYL D-DICLOSENALC SODIUM	ORSE
	24 H	48 H	1 H	2 H	4 H	8 H	12 H	24 H	48 H	1 H	2 H	4 H	12 H	24 H	48 H			
50	78	98	100	98	98	97	97	100	100	1	1		1	0	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
51	86	86	100	99	100	98	98	100	100	1	1		0	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
52	80	80	100	97	99	100	100	97	100	1	1		0	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
53	84	82	100	97	98	98	98	100	100	1	1		0	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	Nausea + Vomitting +
54	88	90	100	99	100	99	99	100	99	1	0	1	1	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
55	88	86	100	100	100	100	100	100	100	0	1	0	1	1	1	-	Fentanyl - 1 Doses Diclofenac - 1 Doses	-
56	82	80	99	100	100	98	100	99	100	1	1	1	0	1	1	-	Nil	-
57	82	80	100	100	100	98	100	100	96	1	1	0	1	1	1	1	Nil	-
58	86	86	99	98	97	98	98	98	98	0	0	1	1	1	1	-	Nil	-
59	80	82	100	98	97	97	98	99	100	0	1	1	1	1	1	-	Nil	-
60	82	80	100	100	100	99	100	99	100	1	1	1	0	0	0	-	Nil	-